69

THE JOHN CRERA
APR 9

THE HEATING AND VENTILATING MAGAZINE

Vol. XII. No. 3.
$1.00 a year. 10 cents a copy

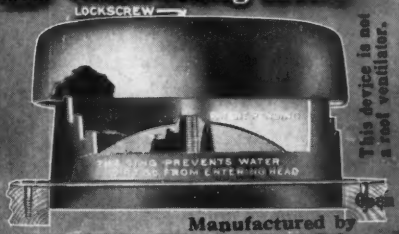
NEW YORK, MARCH, 1915.

Publication Office:
1123 Broadway, New York

GURNEY HEATERS
FOR HEATING ANY DESCRIPTION OF BUILDING BY STEAM OR HOT WATER
GURNEY HEATER MANUFACTURING CO.
NEW YORK OFFICE 12 E. 42ND ST 188-200 FRANKLIN ST. BOSTON.

THE "GLOBE" VENTILATOR
COPPER AND GALVANIZED IRON
SIMPLE, SYMMETRICAL, STORM PROOF, SUCCESSFUL
Model and Blue Print on Application
GLOBE VENTILATOR CO., TROY, N. Y.

Knowles Mushroom Diffuser and Air Controlling Head (Improved Notch Style) ADJUSTABLE



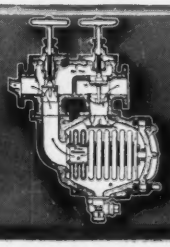
This device is not a roof ventilator. Placed under seats in all auditoriums. A perfect Air Controlling Head and Diffuser, assuring *uniform distribution.*

Manufactured by
Knowles Mushroom Ventilator Co.
Successor to Geo. E. Knowles 9 Church St., New York
Telephone, Cortlandt 7811

AIR DUCT TEMPERATURES
Should be continuously recorded by means of
TRADE MARK
BRISTOL'S
REG. U. S. PAT. OFFICE.
Recording Thermometers

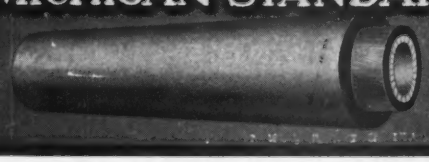
Temperatures at several points may be secured with these automatic recorders in rooms occupied, and the chart records compared each day to guide operation of heating and ventilating systems.

THE BRISTOL CO., Waterbury, Conn
Branch Offices:
111 Liberty Street New York 1670 Frick Bldg. Annex Pittsburgh, Pa
738 Monadnock Block, Chicago, Ill.



ROSS
FEED-WATER FILTERS
Will Keep Oil Out of Your Boiler
Regulating Valves for Water, Steam, Air
Ross Valve Mfg. Co. Troy, N. Y.
Ask for List of Users

MICHIGAN STANDARD TIN-LINED WOOD COVERING
FOR INSULATING UNDERGROUND STEAM PIPES



SIMPLE DURABLE EFFICIENT
THE MICHIGAN PIPE CO., Bay City, Mich.

Entered as second-class matter at the Post-Office in New York, N. Y. Copyright, 1915, by Heating and Ventilating Magazine Co.

THE CASH REGISTER OF COAL PILE ENGINE ROOM HEATING SYSTEM

A complete Cochrane Metering System gives control of the economy of the boiler plant, the economy of the turbine room, and the heat consumed in the heating system.

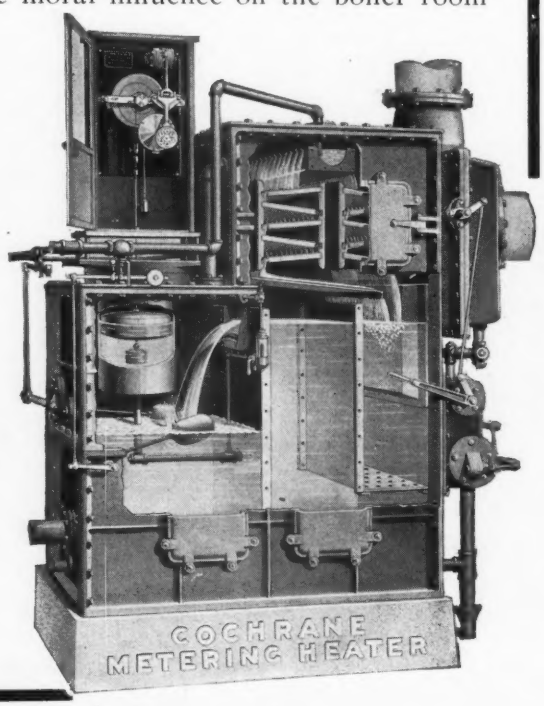
The Cochrane Metering Hot Well in connection with the heating system enables you to charge each building with its condensation or to have a check upon condensation in industrial processes, as drying systems, cooking kettles, slashers, drying rolls, etc. A Cochrane Meter of this type supplied to the Harvard Medical School is used for purposes of accounting between different departments and buildings.

THE COCHRANE METERING HEATER

or the Cochrane Independent Meter for boiler feed service, shows when the evaporation is below normal, hence prompts investigation of kind or grade of coal used, method of firing, possibility of air leaks, scale or soot on boiler tubes, regulation of draft, and other factors through which performance can be improved. It further has a valuable moral influence on the boiler room operating force.

The Cochrane Metering Hot Well determines the steam consumption of each of the turbines, which in comparison with the watthour meter at once detects low efficiency, as due to eroded or injured blades or to accumulation of scale on blades or in passages of turbines.

This Cochrane Metering System is indispensable for scientific management of the steam power plant. Send for our booklet on **"Hot Water Meters and their Practical Applications."**



HARRISON SAFETY BOILER WORKS

3189 North 17th Street, PHILADELPHIA, PA.

THE HEATING AND VENTILATING MAGAZINE

1123 BROADWAY NEW YORK MARCH, 1915

The Relation of the Architect and the Engineer

BY D. D. KIMBALL.

PRESIDENT, AMERICAN SOCIETY OF HEATING AND VENTILATING ENGINEERS; MEMBER, NEW YORK STATE COMMISSION ON VENTILATION.

(Read before the Pittsburgh Chapter, American Institute of Architects, and here first published.)

Twenty-two years in engineering work and in constant association with architects and architectural practices has brought to me a realization of the great divergence in views among architects concerning the engineering phase of the architect's work, especially regarding the necessity of employing an engineer, the method of the selection of the engineer, the relations of the architect and engineer during the planning and the execution of the work, the owner's liability for payment (in whole or in part) of the extra cost of engineering services, and on all matters relating to the domestic equipment of large buildings.

The subject is especially timely because of the ever-increasing demand on the part of owners and the occupants of buildings for variety of service, because of the multiplication of equipment available, and because of the entire lack of any accepted method of procedure.

The subject is of the utmost importance to owners and architects because it involves the success of nearly all large structures, be they office buildings, churches, theatres, hotels, hospitals, factories, mercantile establishments or whatnot.

PREVAILING PRACTICES.

The first consideration in plan making is the provision for a building having suitable spaces for all purposes; the second essential is that the building shall be structurally sound; the third is that it shall be esthetically satisfactory, and the fourth requirement is that it shall be made habitable by the installation of adequate heating, ventilating, lighting, sanitary, refrigeration, elevator, vacuum cleaning and general domestic equipment.

The first three requirements may be considered as constituting the structure, and the fourth item, to which this treatise is devoted, as constituting the equipment of the structure. The architect is, presumably by training and experience, capable of preparing plans and specifications for the erection of the structure. The problem, then, is that of the method of procuring the plans and specifications for the equipment of the building.

Very few architects have, as members of their staff, competent heating, ventilating, electrical and sanitary engineers. The fact of the matter is that a vast amount of architectural work is required to warrant the maintenance of an engineering department. Unless a high grade

of engineering talent is employed disastrous results are sure to ensue. Further, where the maintenance of an engineering department is dependent upon the work of one architect's office only, it is very difficult to maintain such a volume of work as will keep the engineers busy at all times, and, unless this can be done, the engineering department becomes expensive to maintain, while to alternately employ and dismiss such engineers is manifestly unsatisfactory and expensive. However, where the architect has sufficient work to warrant the establishment and maintenance of an engineering department the advisability of so doing may not be questioned.

Many of the large architectural offices employ consulting engineers for the preparation of the plans and specifications and the supervision of the installation of the equipment. Undoubtedly the best and most varied talent can be secured at the least cost in this way. Mention need hardly be made of the importance of selecting engineers having a thorough organization, a long and wide experience, a well-recognized standing, and no contracting or manufacturing interests.

Another method of procuring plans and specifications for the domestic equipments is that of allowing a number of contractors to submit plans and specifications for such work in competition. This method, however, is but little used (unless it be for small country school houses), and fortunately so, for no more iniquitous scheme could be devised. It merely puts a premium upon the cheapest thing possible, which is usually the least efficient, and it almost inevitably results in the practice familiary known as "skinning the job."

THE PREPARATION OF PLANS BY CONTRACTORS AND MANUFACTURERS

The method, which unfortunately, is still most in vogue for procuring plans and specifications for equipment is that of allowing some contractor or manufacturer, or an engineer in the employ of a contractor or manufacturer, to prepare, usually without charge, the plans and specifications for this work. The result of this course, and the following statement will be verified by every experienced observer in the engineering profession or trades, is that in nine cases out of ten the contractor who gives this service is the one who becomes the successful bidder, or the manufacturer who makes the plans secures the order for that portion of the work in which he is interested. This fact explains why the contractor and manufacturer are so willing to prepare plans and specifications, which are often very expensive. If further reason were necessary it exists in the contractor's natural desire to secure and maintain the good will of the architect, which he does by supplying a real need of the architect and by relieving him of a large item of expense. Then do not forget that the contractor and manufacturer are engaged in the business of selling materials.

As a modification of this plan an agreement is sometimes entered into between the architect and contractor whereby the contractor shall be paid a small fee, say one-half to one and one-half per cent., if he should fail to be the successful bidder, and nothing if he is successful. This is unfair to owner, architect and contractor. It would be just as fair to the owner, except in point of degree, to allow a building contractor to draw the general construction plans for the building on the same basis. Independent expert services are not secured, the architect is placed under embarrassing obligations (or else is regarded by the contractor as lacking in appreciation and loyalty) and the contractor renders the service at less than cost for the same reason that on other occasions he renders the service without charge.

Such contractors' engineering has proven to be the most prolific source of padding of plans and specifications and pooling of bids.

If the architect were capable of passing judgment on the suitability or the efficiency of the plans made by the contractor, on the quality or quantity of materials provided or on the capacity of the apparatus he would not be obliged to use such services in the making of plans and specifications.

An architect may admit that the use of contractor's plans is not the best, or even a correct method, while insisting that if the owner will not pay the extra cost of

engineering services, the owner must take such services as the architect can procure without extra expense. This attitude ignores entirely the fact that that for which the owner pays is independent, expert service and that, in so far as the architect uses a self-interested party in fulfilling his obligations to the owner, he is not carrying out the spirit of his employment.

AN IMPRACTICAL SUGGESTION.

Observe this architect's suggestion of a method of obviating the danger of securing imperfect work when using contractor's plans. Speaking before a contractors' association the necessity was voiced of some sort of a guarantee of the efficiency and quality of the work of the contractor installing the work. The suggestion was made that the contractor's association should have a committee of experts to whom the architect could look for advice, which committee should state in an impartial way whether the contractor had fulfilled the terms of the contract. Should the committee find that the contractor had done shoddy work he should be subjected to punishment by the association, even to the extent of banishment therefrom. Could anything be more absurd? It is certain that this particular architect knows nothing of the cohesive force of a contractors' association.

It can scarcely be disputed that the owner employing an architect does so for the purpose of securing independent expert service, nor can it be disputed that the architect who permits a contractor, with or without pay, to prepare his plans and specifications for the equipment of a building does not render the independent service for which he receives pay. In employing or allowing a contractor to prepare plans and specifications for the domestic equipment the architect, in effect, admits his inability to produce such plans and specifications. Inability in this respect carries with it inability to supervise the installation. Thus the owner and the architect are entirely at the mercy of the contractor. No amount of guarantees required of the contractor will alter this fact.

I venture to assert that there is an element of impropriety on the part of an architect who receives payment for plans and specifications for an equipment which involve knowledge or ability which the architect or a member of his staff cannot furnish, or in other words, accepts pay for plans and specifications which he cannot furnish independently of manufacturing or contracting interests.

TRAINING AND EXPERIENCE OF THE ARCHITECT AND THE ENGINEER.

Architecture is an art of centuries of development and training. Domestic engineering is a modern science. The training for one is not adaptable to the other. As the construction of buildings gradually emerged from those involving merely masonry and carpentry work to the complicated structures and equipments of today the architect was called upon to assume the responsibility for that which was involved in each step of progress, until now the development has reached a point where the conscientious architect realizes that certain things are beyond him, and the owner, for his own good, should realize this.

I submit that architects are not engineers, either by temperament, training or experience. Architecture involves design and plan structure and stability, esthetics and orientation. It has to do with materials which are inert and which will develop his plans, promote strength and give beauty. These requirements involve a long and thorough education and special training and experience. If the engineer is also temperamental it is of a prosaic nature, and little of the esthetic is involved or required. His training, while long, complex and thorough, is of an entirely different nature. His training and work involve the study and utilization of moving elements, such as air, water, steam, electricity and other manifestations of power or potential forms thereof. The architect has to do with the comfort and health of the occupants of the building in their use thereof, and the economy of operation and maintenance.

It is doubtful whether the country or the times have yet produced a man who, in himself, is a master in both branches of work, and as the requirements along all lines continue to grow apace the possibility of the coming of such a man becomes more and more remote. This is essentially the day of specialization.

THE FUNCTIONS OF THE ARCHITECT.

In considering the functions of the architect the discussion will be confined to those which are more or less related to engineering, or are more or less involved in the relation of the architect and the engineer, and we will assume that the architect employs the consulting engineer.

It is manifest that there should be some one person or firm responsible for the delivery to the owner of a complete and thoroughly-equipped building, and it is logical that the architect should be the one to assume this responsibility. To provide such plans and specification as will accomplish this the architect or his assistant must give of his time for consultation with the engineer or his assistant. There should be a thorough discussion of all matters pertaining to the equipment of the building.

The architect must so arrange his plans as to provide spaces for coal, boilers, auxiliary apparatus, fans, motors, heaters, ducts, flues, pipes, radiators, registers, plumbing fixtures and pipes, engines, generators, conduits, panel boards, electric outlets, refrigerating machines, elevators, and every detail of apparatus and equipment. The engineer must adapt his plans for the equipment of the building to suit the available space, the arrangement of the rooms and the esthetic requirements of the building. This naturally involves much patience, study, time and expense on the part of both architect and engineer. Satisfactory results in the plans of both the architect and engineer can result only from a mutual, helpful "give and take" policy. It must be granted that the engineer's responsibility does not wholly relieve the architect from responsibility for seeing that the building and its equipment shall properly come together during the period of construction and be complete at the conclusion of the work.

To a large extent the architect must serve as administrator in co-relating the architectural and engineering plans and specifications, in preparing contracts, in passing on extra items, allowances and payments (after the engineer has checked and approved same) and in every way serving as the centralizing agency for all of the details of the work.

THE FUNCTIONS OF THE ENGINEER.

The engineer should give special attention to a study of the character and purpose of the building. He should prepare a preliminary scheme which should serve as a basis of discussion with the architect and, when desired, with the owner, so that the nature and extent of the equipment may be determined during the early stages of the preparation of the plans. He should be capable of advising in an expert manner on all the problems and details of this equipment. He should be familiar with the cost of materials which is necessary that extravagance be avoided.

The engineer should then prepare the working and detail drawings, with specifications, which involve calculations for all parts and the determination of sizes, the selection of each piece of apparatus and the co-relation of each portion of the equipment to all other portions, and to the building. He should be available to architect and owner for consultations and advice on all matters pertaining to the work, should give all necessary information and instruction to contractors during the bidding and the installation of the work, and in a thorough manner supervise the complete installation, including the giving of all expert inspection of materials and labor. He should make all the necessary tests and report on same to the architect and owner. Knowledge of the value of materials and labor is essential also that he may examine and report upon requests for payments and on extra charges or allowances.

It is the engineer's special province to see that all the requirements of the specifications and contract are met and that an equipment complete in every respect is turned over to the owner. The engineer should also give supervisory care of the operation of the plant for a reasonable term after the completion of the installation, this period to cover that usually required for making necessary adjustments and for familiarizing the owner's employees with the equipment.

CO-OPERATION OF THE ARCHITECT AND THE ENGINEER.

The active co-operation of the architect and engineer is essential to a well designed and properly equipped building.

Lack of such cooperation is bound to result in confusion, overlapping or omissions which will prove embarrassing to the architect and engineer, all of which is needless. On the part of the architect there should be a readiness to meet any reasonable requirements of the engineer for spaces which are essential to an efficient plant. On the other hand the engineer should stand ready to so arrange the equipment as not to mar the character of the building or any of the rooms therein. The engineer should also be prepared to design special equipment to meet special conditions so far as these special conditions do not limit or cripple the efficiency of the equipment.

There are cases in which units of the equipment have caused a hideous appearance in a building just as there are cases in which the insistance of the architect for placing of radiators, registers or other details of the equipment in certain locations have brought about disastrous failures of the equipment, especially of the heating and ventilating plant. While the location of radiators, registers, pipes and other details of a plant are capable of considerable latitude there are certain requirements from which deviation cannot be made without inviting disaster. Especially is this so in the case of a ventilating system, in which the diffusion of the air is most important. An architect in preventing the proper distribution or placing of the units of heating and ventilation system thereby limits the efficiency of the heating and ventilating system.

The engineer should co-operate with the architect in the selection of bidders, in the preparation of contracts and in the issuance of extra orders and certificates of payment. The engineer should supervise the installation of the work placed in his charge but the intimate relations of the building and its equipment demand cooperative supervision of the architect and engineer at those points where the architectural and engineering work tie together.

LOSS OR GAIN IN THE EMPLOYMENT OF THE ENGINEER.

It has always seemed to me that the architect loses his position of dignity and independence if he submits to the use of contractor's or manufacturer's plans. Certainly he lacks that independence of action which is his when employing independent engineers. Especially is this so in passing judgment upon materials and amount of extra orders or allowances. If the contractor or manufacturer who made the plans and specification for the job is the contractor installing the work there is bound to be a feeling of leniency on the part of an appreciative architect, and if the contractor installing the work is other than the contractor making the plans and specifications there is a natural hesitation in asking for additional advice from the maker of the plans and specifications. Also it is a fact that one contractor will rarely make a decision adverse to the interests of another.

If an error is found during or after the installation of a plant designed by a contractor, the cost of remedying the mistake falls upon the architect, for the contractor installing the work, especially if he be not the author of the plans, will not assume the expense of correcting the error, and there could be nothing more ungracious than to ask the contractor who made the plans and specifications gratis, or practically so, and failed to secure the contract, to remedy the mistake.

The architect, in employing independent consulting engineers, gains a very material moral advantage, because the client appreciates that he has secured expert advice in the best way. He has entire independence of action in passing on materials, workmanship, cost of extras and amount of allowances.

The employment of independent engineering services results in the installation of the best plant, at the least cost, and one in which there will be a minimum cost for operation and maintenance. This is the natural result of the selection of material by the engineer free of commercial interest.

The injustice which ensues when one contractor is obliged to bid upon work, the plans for which are prepared by another, is eliminated. Similarly the disadvantages due to the wide variance of contractors' competitive plans are eliminated.

The very real risks incurred when bids are taken upon incomplete plans and specifications are avoided.

Competition inevitably obtains the best results when all contractors bid upon the

same plans prepared by engineers independent of any contracting or manufacturing interests.

The best workmanship is assured because the acceptance of all work and material of the contractor depends upon the approval of disinterested and specially trained experts.

The services of the engineer are of much the same nature, and possess much the same advantages in connection with engineering work as do the services of the architect in connection with the structural and architectural details of the building. Engineering problems require the services of the specially-trained and qualified engineer.

The best results are obtained when the engineer and architect are associated from the earliest stages of the work, thus making possible proper provisions for the installation of the plant and its ramifications, and so avoiding the necessity, which otherwise frequently occurs, of materially altering the plans, or of cramping the plant into a too limited space to its permanent injury. Such a course best harmonizes the various elements of the building and its mechanical equipment.

The concluding portion of Mr. Kimball's paper, which will be published in the April issue, considers, among other things, the relation of the engineer to the matter of separate contracts; also the question of engineers' fees and payments.

The Experimental Plant of the New York State Commission on Ventilation

In view of the comprehensive character of the experiments conducted during the past year by the New York State Commission on Ventilation, considerable interest attaches to its experimental plant which is so arranged that almost any desired air condition can be obtained. The accompanying description of the plant, as well as a detailed report of the experiments conducted, was contained in a paper by D. D. Kimball, member of the commission, and George T. Palmer, chief of the investigating staff, which was presented at the recent annual meeting of the American Society of Heating and Ventilating Engineers.

To give an idea of the scope of the investigation which was made possible by the arrangement of the plant, it may be stated that in the principal experiment conducted, the efficiency in mental work of four subjects, young men about 18 years old, students of the College of the City of New York, was compared in five different atmospheric environments, as follows:

68° F., 50% relative humidity, ample air supply (about 45 cu. ft. per minute per person).

68° F., 50% relative humidity, no air supply (a stagnant condition).

86° F., 80% relative humidity, ample air supply (about 45 cu. ft. per minute per person).

86° F., 80% relative humidity, no air supply (a stagnant condition).

86° F., 80% relative humidity, no air supply (a stagnant condition, but with the presence of small electric fans blowing air on the faces of the subjects).

This experiment was thus planned to give information on the subjects' efficiency in (1) a hot, moist room as compared with a cool room; (2) a room with ample supply of fresh outdoor air as compared with a room in which no air at all was supplied; and (3) a hot, moist room where relief was afforded by the moving air from electric fans.

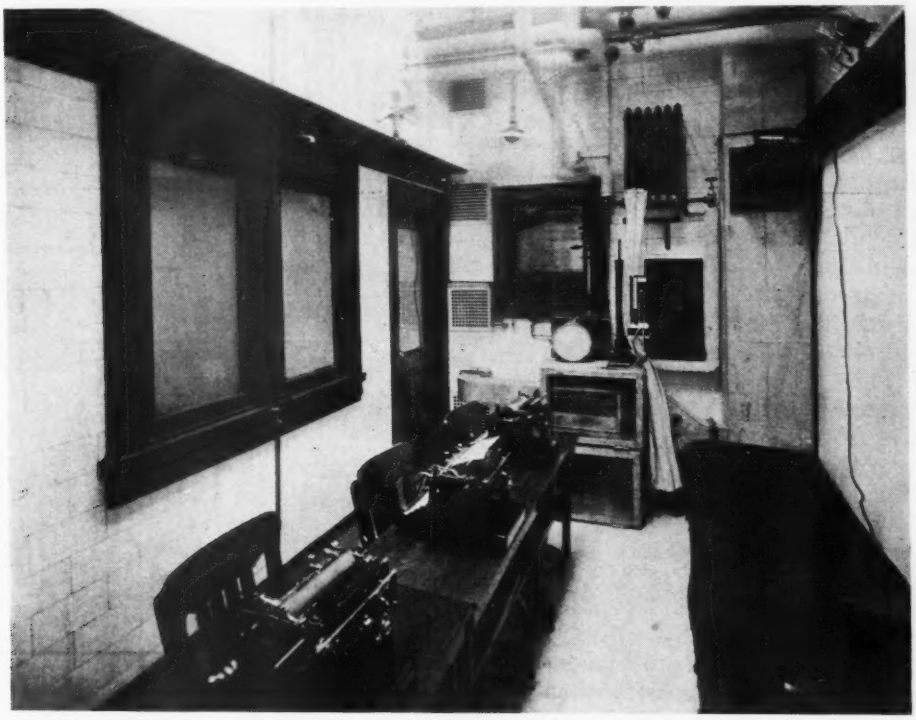
The detailed results of these and other tests are given at length in the report, as noted in the February issue.

The experimental plant is installed in the Biological Laboratories of the College of the City of New York, at 139th Street and St. Nicholas Avenue, New York, where it occupies two rooms. It was aimed to make possible the maintenance of the same or different atmospheric conditions in the two rooms, with temperatures varying from that existing out of doors or less up to 100° F. in

zero weather, with humidities varying from the saturation point to practically nothing.

Later a cooling system was added to the plant, the cooling of the observation room being accomplished by cooling the water in the air washer and by the use of direct expansion coils on the walls of the observation room.

The conditions in the observation room are under the control of the observers in the control room. They may be manually or automatically maintained.



OBSERVATION ROOM IN EXPERIMENTAL PLANT OF NEW YORK STATE COMMISSION ON VENTILATION.

The air is taken in through a ventilator on the roof and drops to the fresh air fan setting on the floor. The discharge from this fan has two branches, one of which enters the plenum chamber before the tempering coil while the other branch enters beyond the tempering coil. Thus the air may be passed through or by these coils to the air washer or dryer. Over the face of the tempering heater there has been placed a louvred damper so that the heating effect of the heater may be obsolutely and immediately eliminated. To the discharge side of the washer the air for both rooms passed through common channels.

From this point the apparatus is divided into two parts, one for each room. Each part consists of a chamber in which the air from the dryer and washer may be mixed, from which the air passes through reheaters and thence to the rooms. In the observation room this air enters a 12 by 18 in. vertical duct the height of the rooms, having four 12 by 12 in. openings so that the air may enter the room at any one of four levels.

A similar vertical exhaust duct is placed in the apparatus room with four openings from the observation room and one from the apparatus room. From this duct the air is drawn by the exhaust fan, by which it may be discharged into the attic space above the ceiling or back to the fresh air fan for recirculation, if desired. Dampers are provided for regulating the flow and volume of the air. Special openings, 1 in. in diameter, with tight fitting covers, are placed at convenient points for air measuring and sampling.

The fans were furnished by the Massachusetts Fan Co. and are of the squirrel cage, or multivane, type, being different only in the direction of discharge, otherwise the same description applies to both fans.

The fresh air supply is a No. 1 top vertical discharge fan with outlet 8 in. x 9 in. The exhaust fan is the same size, but is a top horizontal discharge fan, with outlet 8 in. x 9 in.

The runners are 12 in. in diameter by 6 in. in width, the width being uniform. The fans being of the multivane type, the blades are pitched forward in the direction of rotation, as the action of these fans depends upon the kinetic energy rather than upon the centrifugal force, building up a pressure within the housing. The inlets are large compared to the diameter of the wheel, being 9¾ in. at the upper base of the frustrated cone, while the diameter of the lower base is 13 in.

The mechanical efficiency of the fans, when operating at 25% restriction from free discharge, under laboratory tests, is 54%.

The motors, which were manufactured by the Diehl Mfg. Co., are designed to operate these fans at 850 r.p.m. and are equipped with speed regulators, by means of which the speed may be reduced 50% through armature resistance.

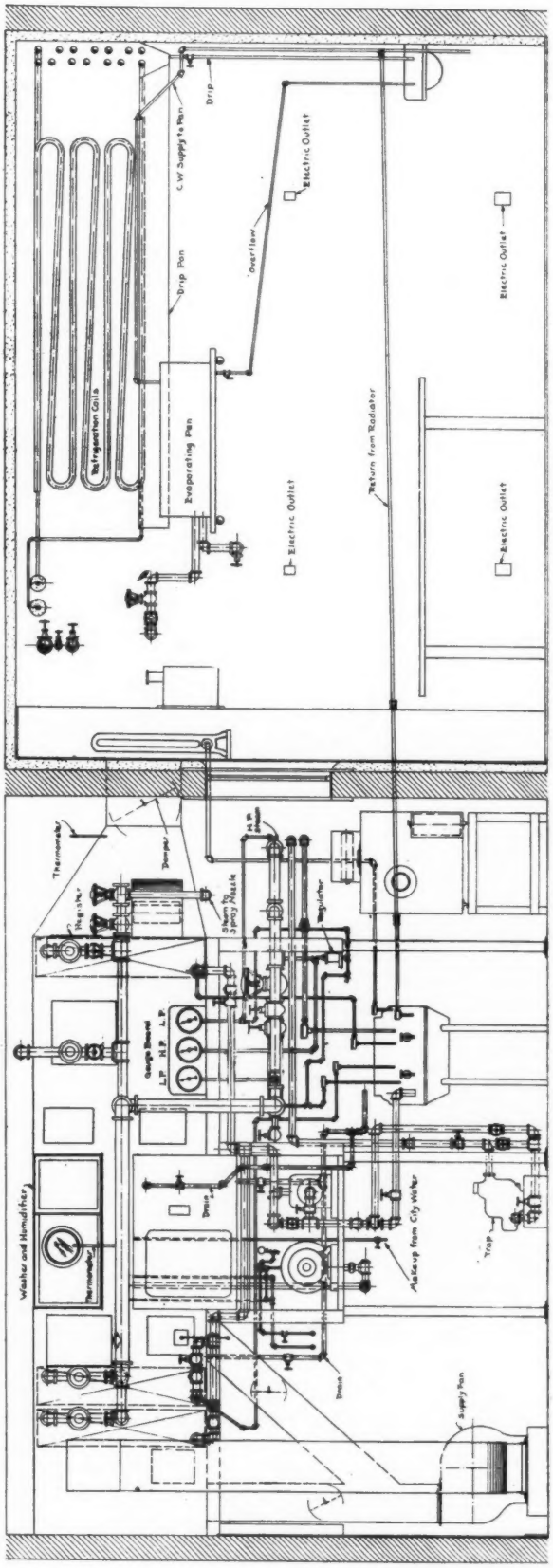
Each motor is a ½ h. p., 230 volt, shunt wound, type G, frame No. 302, and is direct connected to the fan.

The tempering heater consists of two rows of 40 in. regular Vento heater sections, each row six sections wide, sections 5⅜ in. center to center. This heater is common to the work of both rooms.

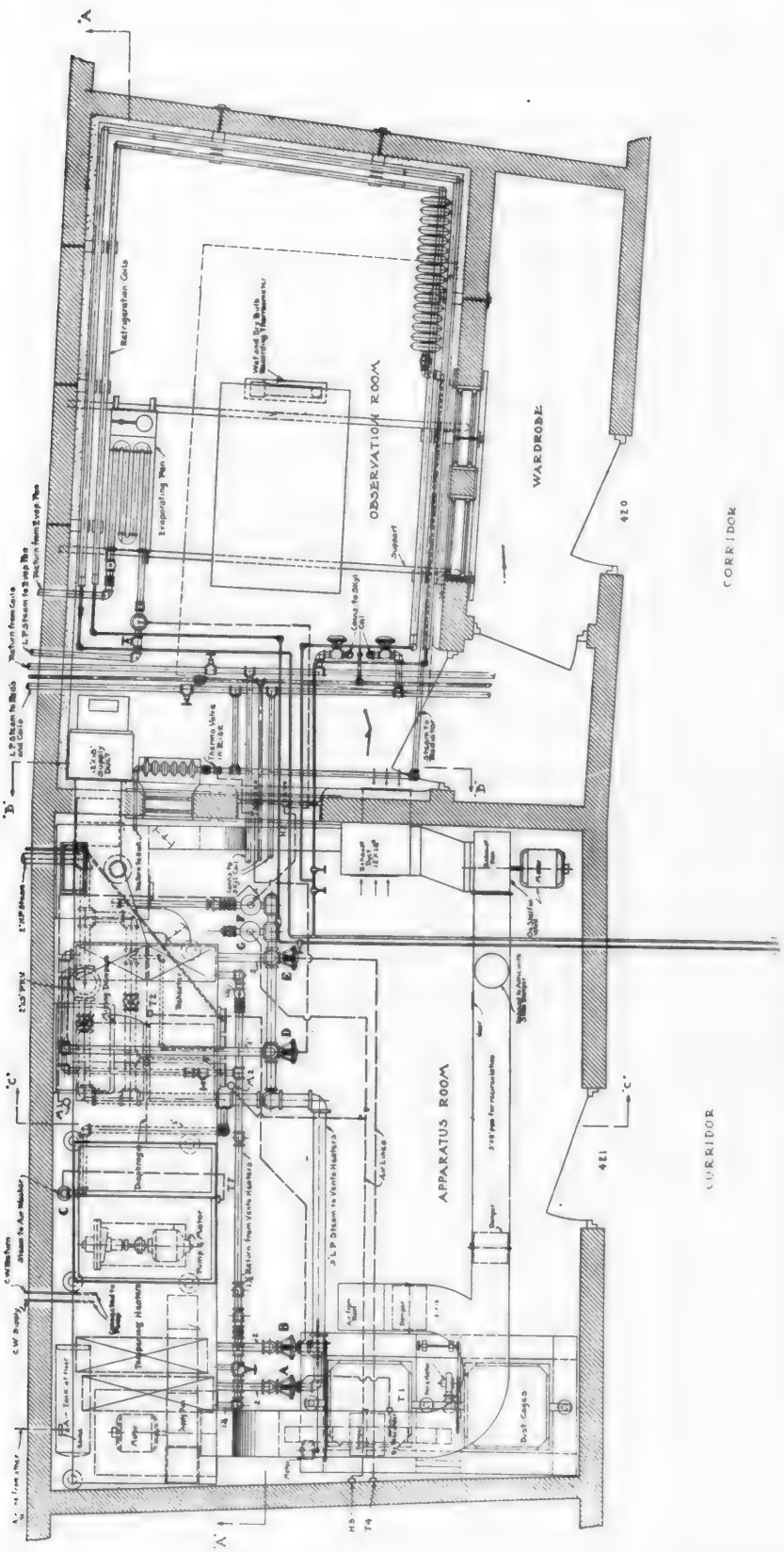
The two reheaters, there being a separate reheater for each room, each consists of one row of 40 in. regular Vento heaters as above, six sections wide, 5⅜ in. center to center.

The air washer was specially made for this work by the Warren Webster Co., and is 36 in. long, 15 in. high and 36 in. wide, with a water tank 8 in. deep under the washer.

The circulation pump is of the rotary type with cast iron casings and bronze impelled, driven by direct-connected Crocker-Wheeler, direct current 230-volt, shunt-wound, electric motor of ⅓ h. p.



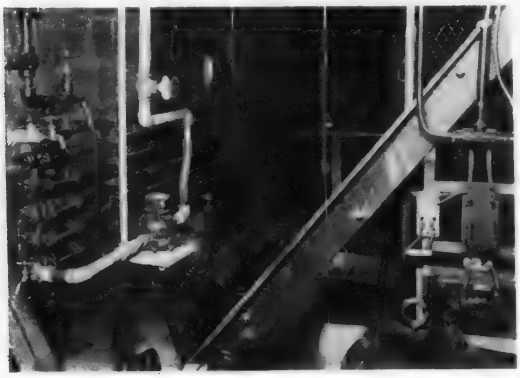
ELEVATION ON LINE A-A OF APPARATUS AND OBSERVATION ROOMS.


OBSERVATION ROOM
WARDROBE
CORRIDOR
APPARATUS ROOM
CORRIDOR
Refrigeration Coils
Evaporating Pan
Wet and Dry Bulb Recording Thermometer
Support
Thermo Valve in Blast
Heating Coils
Tempering Heaters
Pump & Motor
Air Lines
Dust Chamber
Dust Cages
Drain
Sump
Return
Blast
Exhaust
Supply
Return from Coils
Return from Drop Pan
Return from Vento Heaters
Steam to Air Heaters
Steam to Vento Heaters
Steam to Coils
Steam to Drop Pan
Steam to Blast and Coils
Steam to Tempering Heaters
Steam to Dust Chamber
Steam to Dust Cages
Steam to Pump
Steam to Drain
Steam to Sump
Steam to Support
Steam to Refrigeration Coils
Steam to Evaporating Pan
Steam to Wet and Dry Bulb Recording Thermometer
Steam to Thermo Valve in Blast
Steam to Heating

Under the washer is a drying tank to be used for drying the air for securing dry air in the observation room when desired. It consists of a galvanized iron box, 36 in. long, 36 in. wide, and 24 in. deep, containing four shelves, each in two sections, covering the entire area of the box, these shelves consisting of ⅛ in. mesh No. 16 galvanized iron wire screen, edges of same bound over ¼ in. galvanized wire, shelves supported on angle and tee irons. It was proposed to dry the air by the use of calcium chloride placed upon the shelves. A 1 in. drain from this tank to sink below is to be provided as shown. The use of this device has not proved practicable with volumes of air used to date.

The above described apparatus is capable of delivering 800 cu. ft. of air per minute maximum, with provision for reducing the amount of air to 60 cu. ft. or 30 cu. ft. per minute minimum for each room.

Steam is supplied to the apparatus from a high pressure line brought up from the basement from the Biological



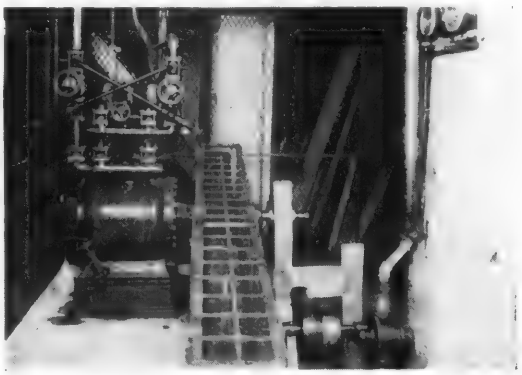
ARTIFICIAL COOLING APPARATUS, SHOWING AMMONIA CONDENSING COILS, WATER METER AND AMMONIA RECEIVER.

Laboratories through a 2 in. pipe, the steam passing through a 2 by 3 in. Victor pressure reducing valve into a 3 in. pipe with 2 in. supply connection to each section of the heater and a 1 in. connection to the water heater in the tank of the air washer. One-half inch connections are also made to each of the air discharge ducts for use in humidifying experiments if desired. From each heater a 1¼ in. return pipe is connected into a 1½ in. return main, discharging through an Anderson trap either into the return of the heating system of the building or into the sink.

All steam and return pipes and fittings and the ducts are covered with H. W. Johns-Manville Co.'s 85% magnesia sectional covering.

ARRANGEMENT OF AUTOMATIC HEAT AND HUMIDITY CONTROL APPARATUS.

The automatic temperature and humidity controlling system was manufactured and installed by the Standard Regulator



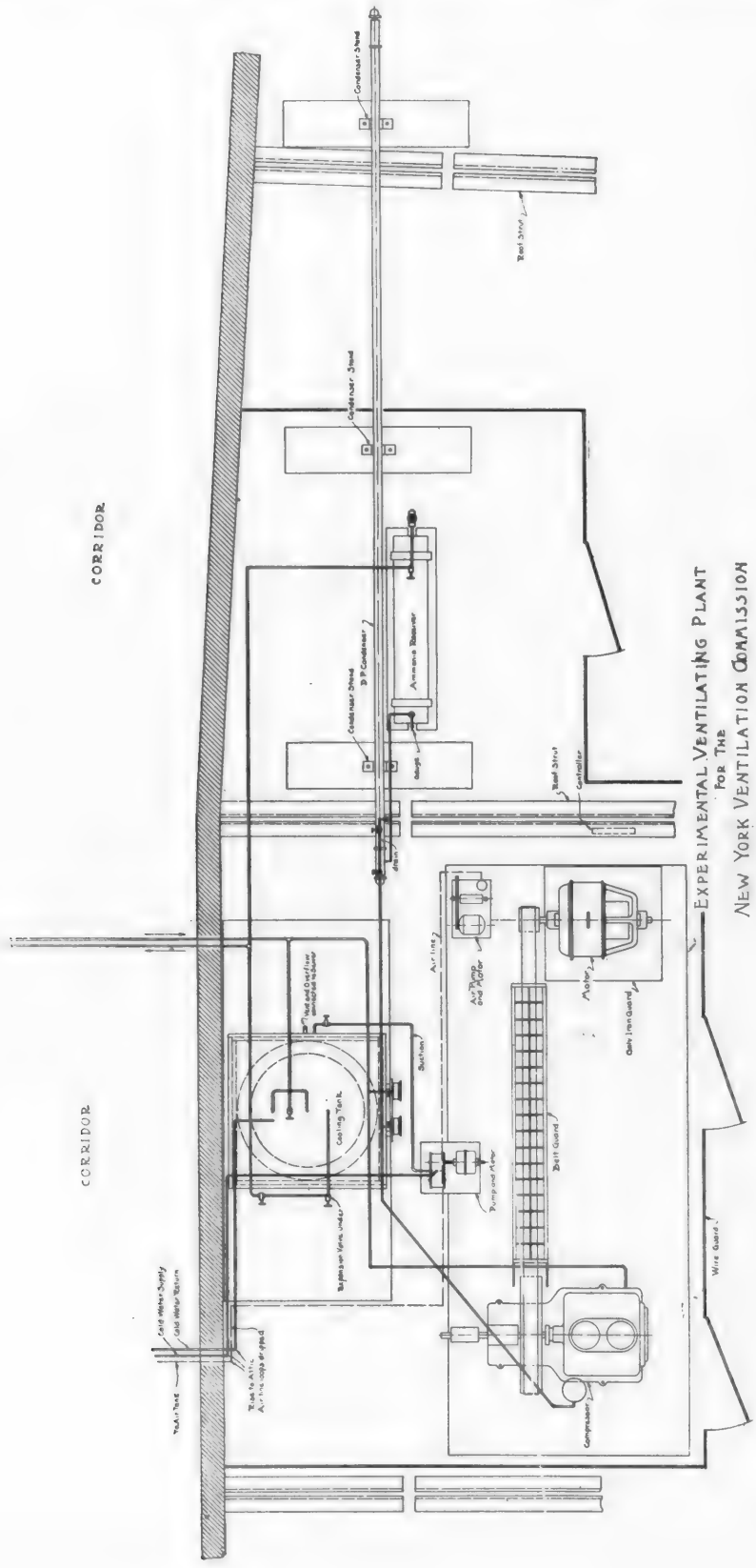
AMMONIA COMPRESSOR, ROTARY PUMP AND COLD WATER TANK FOR REFRIGERATING PLANT.

Company. This installation originally included a small hydraulic air compressor which was later replaced with an electric compressor. The aim is to provide and maintain automatically any temperature and humidity desired in either room within 1° in temperature and 2% in relative humidity.

The temperature of the incoming air passing through the primary and reheating coils is controlled primarily by thermostat "T-1," located in the intake duct, secondarily by thermostat "T-2," located in the space between the heater and air washer, and finally by thermostats "T-3" and "T-4," located in the observation and control rooms.

Thermostat "T-1" controls diaphragm valve "A" on the outside section of the tempering coil, and is adjusted to open the valve when the incoming air is at or below 35°. It is intended that at no time shall the inner section of the coil or air washer be exposed to freezing temperatures.

Thermostat "T-2" controls diaphragm valve "B" on the inner section of the



PLAN OF REFRIGERATING SYSTEM, EXPERIMENTAL PLANT OF THE NEW YORK STATE VENTILATION COMMISSION.

tempering coil. Its function is to control the temperature of the air entering the air washer and is adjustable to any predetermined degree.

Thermostat "T-3" is located in the observation room and controls diaphragm valve "D" on that part of the reheater coil supplying heat to the room. It also controls the diaphragm valves on the direct radiators located in that room. This thermostat has an extended thermostatic member projecting into the room, with the adjustment so arranged that it may be operated from the control room.

Means of creating and controlling humidity is provided in two ways, the first being to condense steam directly in the air washer water, thereby supplying sufficient heat to the water to permit a rapid absorption of moisture by the air passing through the air washer. The heat supplied to the water is controlled by thermostat "T-7," which has its thermostatic member submerged in the settling tank. This thermostat controls diaphragm valve "C" on the steam supply to the water heater. As the temperature of the air entering the washer is held uniform by thermostat "T-2" and the temperature of the washer water is held uniform by thermostat "T-7," the relative humidity of the air leaving the washer is held constant. The relative humidity may be increased by raising the adjustment of thermostat "T-7" or raising the adjustment of "T-2."

OBSERVATION ROOM OCCUPIED, EXPERIMENTAL PLANT, NEW YORK STATE COMMISSION ON VENTILATION.

Thermostat "T-4" is located in the control room and operates diaphragm valve "E" in that part of the reheater supplying heat to this room, also the direct radiators located in the room.

The temperature of the space between the inner and outer skylights in each of the rooms is controlled by thermostats "T-5" and "T-6," located in the mentioned space, which thermostats operate diaphragm valves on the skylight coils. The adjustment of these thermostats can be operated from the floor by means of chain pulls.

A second means of creating humidity was provided for by discharging steam through a nozzle directly into the air after it leaves the reheater coils. The control for this scheme was obtained by the use of hygrostat "H-2" located in the

observation room and "H-3" located in the control room. Hygrostat "H-2" controls diaphragm valve "F" on the steam supply to the nozzle in the duct supplying air to the observation room. Hygrostat "H-3" is located in the control room and controls diaphragm valve "G" on the steam supply to the nozzle for the air supply to that room.

The use of the steam nozzles not proving satisfactory, an evaporating pan with submerged coil was installed in the observation room, the operation of this coil being controlled by hygrostat "H-2."

Hygrostat "H-2" has its thermostatic members projecting into the observation room, with the mechanism arranged so that it may be adjusted from the control room.

Hygrostat "H-2" was intended to be employed to operate lever motor "M-1," and hygrostat "H-3" to operate lever motor "M-2," for the control of the amount of air to be passed through the dryer.

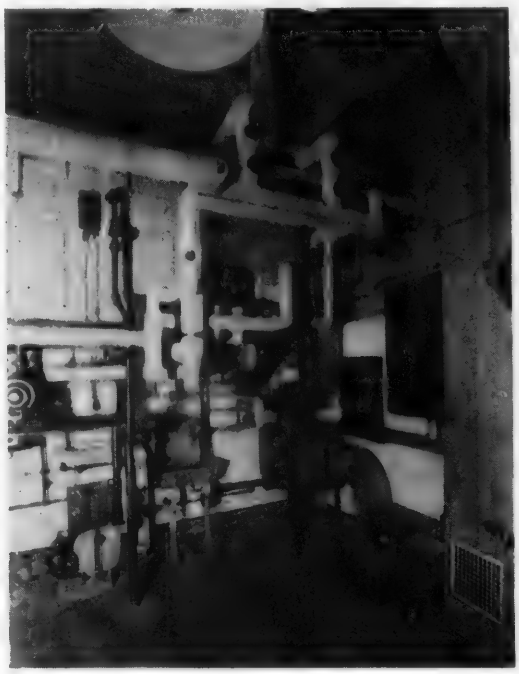
The motive power for the thermostats and hygrostats is pneumatic pressure originally generated by a 2½ by 3 by 6 in. hydraulic air compressor of one cubic foot of free air per minute capacity. This was later replaced by an electrically operated compressor.

Each fresh air and vent or exhaust opening is provided with an air equalizing register, these registers being equipped with adjustable louvres, key operated.

Three animal cages were constructed, each 36 in. long, 24 in. wide and 16 in. high of No. 20 galvanized iron, all joints being soldered, with removable door in front, full size of front of box, the door being glazed with tight fitting wired glass provided with rubber packing against which the door fits tightly. Later two revolving glass cages with stationary wire cages therein were constructed. These cages are used in animal studies, principally on dust. These boxes were all provided with fresh air and exhaust connections.

The cooling plant, which was later installed, was furnished by the Brunswick Refrigerating Co., and included a single acting compressor of four tons refrigerating capacity. The compressor is of the belt-driven, two-cylinder, single-acting,

CORNER OF CONTROL ROOM, SHOWING INLET DUCT FROM ROOF OF BUILDING, SUCTION FAN, ENCLOSED PRIMARY HEATERS, AIR WASHER, ETC.



ANOTHER VIEW IN CONTROL ROOM, SHOWING AIR WASHER, SPACE IN WHICH REHEATERS ARE PLACED, EXHAUST DUCT FROM OBSERVATION ROOM, AND CENTRIFUGAL PUMP TO AIR WASHER SPRAYS.

enclosed self-oiling eccentric drive type, provided with self-acting head pressure relief valve and by-pass between suction and discharge sides. Each cylinder is 4⅞ by 4⅜ in.

The condenser for liquefying the ammonia is of the inner tube type, 19 ft. long by 6 pipes high and made of 1¼ in. and 2 in. special ammonia pipe.

The liquid ammonia receiver is 48 in. long by 10 in. diameter, with gauge glass, draw-cocks, inlet and outlet valves, and connections required.

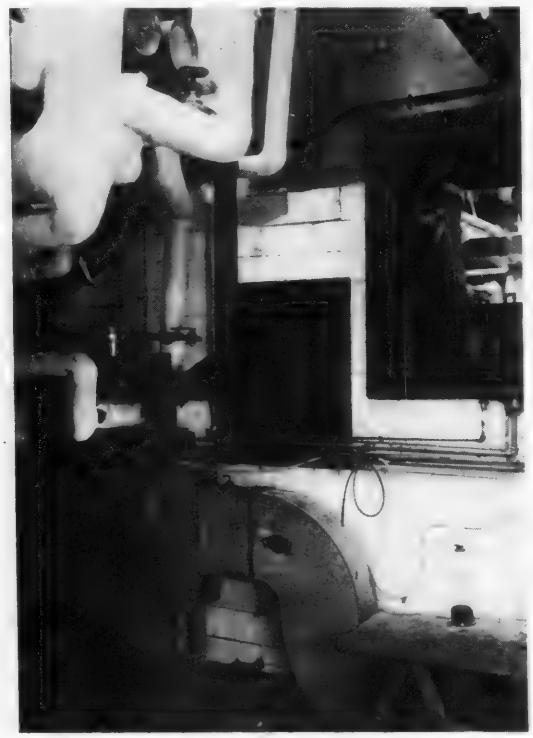
The oil interceptor is 36 in. long and 6 in. diameter.

A full set of 4½ in. gauges are mounted on a cast-iron gauge board.

The usual scale traps, valves, cocks, ammonia pipe, fittings, etc., to connect up the above are provided.

The motor is a 7½ h. p., 230 volt, D. C., 650 r. p. m. electric motor of Westinghouse make with rails, sliding base, pulley, starter and 5 in. belt for transmitting the power from the motor to the compressor.

The water cooling tank is 6 ft. high by 2 ft. 6 in. in diameter. This tank is made of 3/16 in. tank steel. Its insulation consists of granulated cork, waterproof insulating paper, and ⅞ in. boards.



PART OF CONTROL ROOM ADJACENT TO OBSERVATION ROOM.
Showing Windows Leading to Observation Room, with Thermostats and Humidostats.

APPARATUS USED IN PHYSIOLOGICAL EXPERIMENTS.
1. Spirometer.
2. Continuous Body Temperature Recorder.
3. Bicycle Ergometer.

The water is cooled by means of about 200 lin. ft. of 1¼ in. continuous electric welded wrought-iron direct expansion ammonia pipe.

The water circulating pump has a capacity of 5 gal. per minute and is of the rotary type. An extra pulley is placed on the extended compressor shaft and a 2 in. wide belt is provided for transmitting power from compressor shaft to pump.

The water tank is capable of cooling 75 gal. of water per hour through a range of 40° F.

The cooling of the observation room may be accomplished by the use of cooled water in the washer, or directly, as is necessary when stagnant conditions are desired, by the use of the 300 lin. ft. of 1¼ in. direct expansion ammonia pipe made up into coils to suit the wall space conditions. These coils are so arranged that, if desired, only one-half the total need be used, but with all the coils in operation, and the compression side working only on these coils a temperature of approximately 50° F. can be produced in the observation room, when five persons are at work therein, with five 40-watt lamps and a 1 h. p. motor in operation, and with an outside temperature of close to 90° F.

The ammonia piping is covered with 2 in. of sectional molded cork pipe covering.

The Recirculating of Air in a School in Minneapolis

By Frederick Bass.

(*Presented at the annual meeting of The American Society of Heating and Ventilating Engineers, New York, January 20-22, 1915.*)

The experiments to be described below were conducted in the same school buildings of Minneapolis, the Jackson and the Adams, in which similar experiments were conducted the year before and which were described in Vol. 19, transactions of this society on pages 328-350.* The period covered by the experiments was approximately four months.

The experiments this year were carried on in co-operation with the New York State Commission on Ventilation, and the funds were provided from a gift made to that Commission by Mrs. Elizabeth Milbank Anderson through the New York Association for Improving the Condition of the Poor.

One room in each of the school buildings named was selected for experiment. In each room the pupils were of the same grade and about nine years of age. The room in which the air was recirculated had an average attendance of 39.5, and the average quantity of air furnished per pupil was 8.9 cu. ft. per minute. The air was introduced at each desk top through funnel-shaped orifices and also through openings in pipes running along the top of the black boards at the end of the room. Air was exhausted at the ceiling through fifteen 3-in. orifices, evenly spaced. The air exhausted from the room was for the greater part of the time passed through a Warren Webster air washer, cooled about 15° F. and returned to the room.

In the Adams School the usual system of plenum fan ventilation was used. The average attendance in this room was 41 and the amount of air furnished per pupil was 35.4 cu. ft. per minute. The air was delivered by the fan supplying the whole building, was from the outside and received no treatment except that of being heated.

RECORD OF ROOM CONDITIONS.

Temperature records were kept by recording thermometers attached to inside walls about 7 ft. above the floor. The temperature of the air in the room was also ascertained at ten different points, five evenly spaced at the floor level and five at the height of about 4 ft. above the floor. The temperature of the incoming and outgoing air was also ascertained. Average temperature at inlet 56.0° ; average temperature at outlet 70.4° F.

The relative humidity of the air was determined by use of hygrodeiks which had been compared with a sling psychrometer.

The carbon dioxide contents of the air of the rooms were determined by the use of a Petterson-Palmquist apparatus.

Dust counts were made by means of filtering 3 cu. ft. through 25 grams of resorcin. The average results are shown in Table 1.

TABLE 1—AVERAGE CONDITIONS OF ROOMS.

	Temp. Deg. F.	Relative Humidity P. Ct.	CO_2 p.p. 10,000	Dust Count
Adams (control) ..	67.2	42.2	9.1	225,000
Jackson (experimental.	65.3	46.3	12.5	105,000

Outside temperature, humidity, precipitation, direction and velocity of the wind, were also recorded.

It was impossible to keep the windows closed at all times, and as it was not practical to keep an observer at the school throughout each day the periods in which the windows were opened were not at all times determined, although it is certain that windows were closed in the experimental room in the Jackson School, except for very short periods in the later days.

PHYSIOLOGICAL EXAMINATION OF PUPILS.

It was found necessary to get the written consent of the parents of all the pupils before the school board would allow the work to begin. The consent of the majority of the parents was obtained with

*Also published in The Heating and Ventilating Magazine for August, 1914.

some difficulty. At the beginning of the experiment, at the end and at a number of times during the experiment the children were all examined by a physician. They were examined for physical defects at first.* Blood pressure was determined in two positions, but the technique followed by the physician was not such as to give the best results. Records of attendance, of progress in height, weight and chest measurements were also observed. Table No. 2 shows the result of the examinations.

TABLE 2—GAIN IN MEASUREMENTS OF PUPILS AND ATTENDANCE.

	Chest Inches	Height Inches	Weight Pounds	P. Ct. of Absences
Adams ..	0.14	0.409	1.28	5.3
Jackson .	0.58	0.298	0.75	4.1

At the time when the consent of the parents to the examination of the children was obtained, careful examination of the home environment of each child was estimated. They are classified in Table No. 3.

TABLE 3—HOME CONDITIONS.

	Good	Fair	Poor
Adams	12	3	3
Jackson	8	3	7

The children of the control group not only lived in better houses, but they were reported by the physician as giving evidence of better care, their teeth being in better condition, their bodies cleaner, etc.

PSYCHOLOGICAL TESTS.

Four psychological tests were given, a division test, a substitution test and two cancellation tests. The results from these tests have been plotted and are shown on Plates 1-4, inclusive.

CONCLUSION.

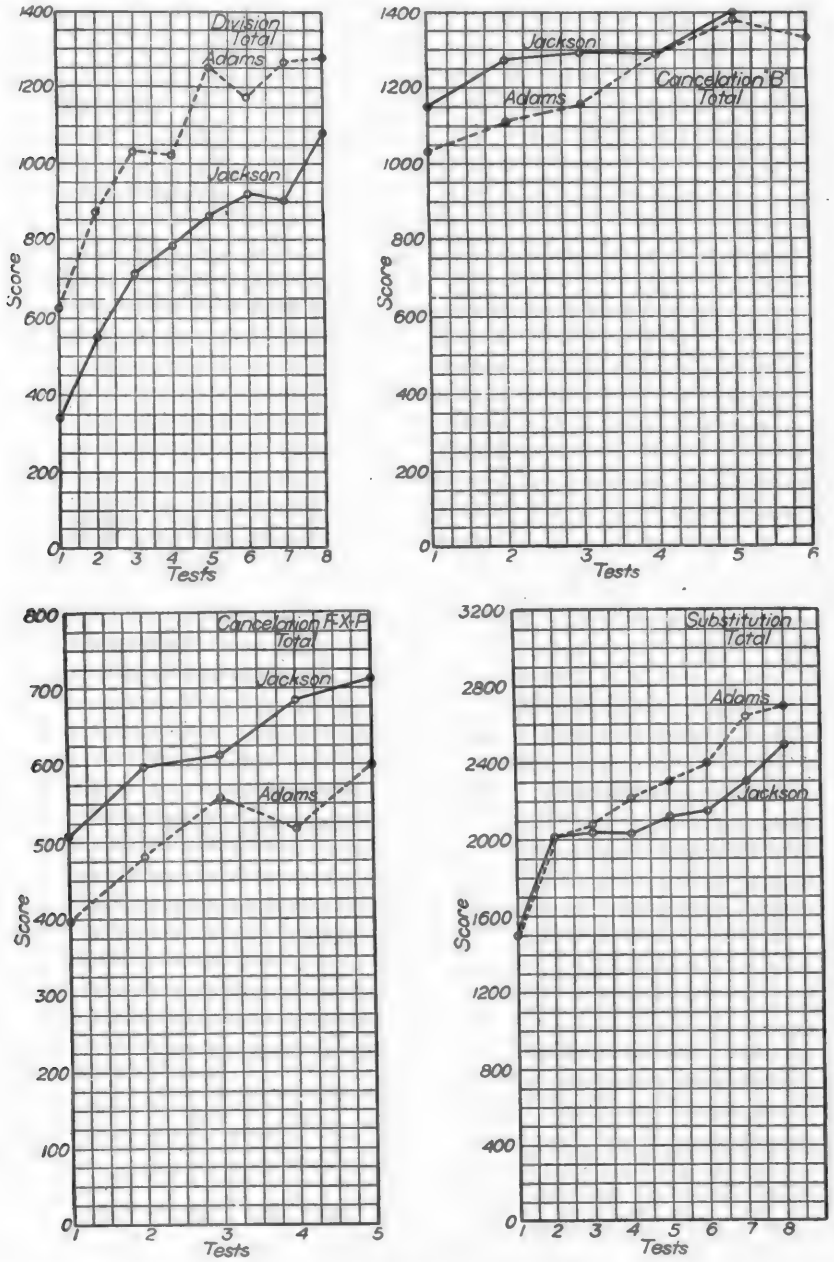
An examination of the conditions in the rooms indicates that the temperature in the experimental room was 1.9° lower than in the control room. It was also noticed that the temperature at the floor level averaged only 2.4° lower than that 4 ft. above the floor. This seems to indicate that upward ventilation does not leave the floor undesirably cold. Numerous examinations of air currents below the level of the currents on the desks showed that the air was continually in motion. The relative humidity of the two rooms differed by 4.1%. The carbon dioxide of the experimental school was, as might be expected, considerably higher than that of the control. The dust count in the control school was, as might be expected, greater than that in the experimental school where air washing was used. The experimental group gained less in height but increased more in chest measure. The absences due to sickness were greater in the control than in the experimental group, the difference not being very great in any of these particulars.

In the division test the experimental group showed a lower standard of accomplishment, but at the same time greater absolute progress and consequently considerable greater relative progress than the control group. In the substitution test a higher standard was again indicated for the control group, but the progress of each group was about the same. In the cancellation "B" test the control group overtook the experimental group, but the rate of progress was not very considerably greater. In the cancellation "F-X-P" the experimental group made a greater rate of progress than the control group.

In the psychological tests the classes "broke even" on the cancellation tests, and in the division and substitution the initial superiority of the control group is sustained throughout, but the progress made by the control group is not greater than that made by the experimental group.

The pupils in neither room were greatly disturbed by the tests, but the teachers did seem restive. Under the conditions in the experimental schoolroom it was not possible to remove the odors from the air at all times, and the odor at times was objected to by persons entering the room, although they would quickly become accustomed to it and feel comfortable. The teacher in this room said that she felt comfortable, but that other teachers coming into the room noticed the odor in the air and it annoyed her to be reminded that she was teaching in a room where so-called "fresh air" was not being supplied. The carbon dioxide determinations indicated that in spite of the recirculation of the air a large amount of leakage occurred. The character of the pupils themselves was in some instances such that the odors might naturally be expected to be difficult of removal.

These experiments were, as has already been said, conducted during a period of four months, but with all of the close observation that was given it is impossible to demonstrate physical or mental deterioration due to the use of recirculated air. Neither is it possible to ascribe any discomfort on the part of pupils or the teacher to this recirculated air. The air washing was not in itself sufficient to remove all odors so that they could not be noticed by persons at the time of entering the room, but it was sufficient to remove them to such an extent that they were not offensive to persons occupying the room continuously. It would seem that if some method of removing the slight odor could have been utilized that recirculation of air would have been acceptable from every standpoint.



PLATES 1-4—RESULTS OF PSYCHOLOGICAL TESTS IN ADAMS AND JACKSON SCHOOLS, MINNEAPOLIS.

Still further experiments along this line might be undertaken to great advantage,

provided the control of conditions and the character of the observations would be more perfect than in the experiments described, but enough has been done here to show that any deleterious effect of recirculated air upon the occupants of a room during a four months' period is extremely difficult of detection, if, indeed, it exists at all.

(*For discussion of this paper see report of annual meeting of heating engineers' society, in last issue.*)

An Analysis of Modern Ventilation Theories.

By J. M. W. Kitchen, M. D.

It is a comforting matter for the ventilating doctor to have a good theory on which to base his practice, as well as for the medical doctor to have a sound scientific theory on which to found his efforts for the prevention and cure of abnormal conditions. The present movement attributing the evils of poor ventilation to superheat, humidity and air stagnation alone, reminds one of the poor-fit theories that have been adopted so frequently in past times by the medical profession to bolster their more or less successful practice.

There is no question as to the influence of heat, humidity and air stagnation as being in part, at least, the cause of the evil influences of poor ventilation, but it is not clear that deficiency in oxygen content and the presence of bacteria and volatile organic toxic matters are not also causative.

DISEASES MAY BE DUE TO MANY CAUSES.

Up to the present moment we note that various writers ascribe to single specific causes the incidents of rheumatism, cancer and other conditions. As causative of the former trouble, we have had attributed lactic acid, uric acid, intestinal ptomaines, including indican, specific bacteria having selective affinity for the affected tissues, and other specific causes. Yet there is not the slightest reason to doubt that a multitude of causes may be at work inciting and keeping up rheumatic conditions, including poor heart action, following insufficient exercise, poor gastric digestion, too much protein in the food supply, chilling the bodily surface, straining of the affected parts, and defective action of the kidneys, lungs, skin and intestines. More or less of these influences take part in causing so-called rheumatism in its various forms.

All the causative influences that have been suggested as causing the evils of poor ventilation may be at fault; and probably are usually at work in causing ill effects to health. Those which are immediately obvious to perception include humidity and heat; but those which are more slowly perceptive in their effect are those which gradually depress vital activity. The mere presence of carbon dioxide in large percentages need not be considered as being particularly immediately deleterious, for the body is habituated to the presence of that influence; but the absence of oxygen has much to do with determining the sum total of bodily activity. This is clearly shown by the various effects of different atmospheric pressures.

VOLATILE ORGANIC MATTERS MAY BE IRRITATING, IF NOT POISONOUS.

There is considerable reason to believe that the presence of volatile organic poisons emanating from bodily activities may have both undesirable depressing, as well as irritating, influences. If the individual's own body suffers from auto-generated toxic matters originating in the alimentary tract and diffused through the body, why should not a fellow human being suffer from the effects of some of those same materials escaping from the body in the expired air and from the cutaneous surfaces? Volatilized alcohol and nicotine in the atmosphere breathed can unquestionably injuriously affect the body through their inhalation. I have discovered that the volatile emanations from bacterial action in the hides of dairy cattle are conveyed to milk by being breathed by cows; and

there is no more reason to doubt that such volatile substances may be toxic to some degree than there is to doubt that bacterial decompositions of proteids generate toxic poisons or that the fumes of burned tobacco are poisonous.

As a matter of fact, there is no living form of matter that canot be killed by the volatile fumes of tobacco, it being merely a question of degree and time of the exerted influence.

Susceptibility to influence varies in different individuals, and in the same individuals at different times. Persons who are habituated to the influences of bad air do not apparently show the effect of such influences while unhabituated persons would immediately show bad results. The world is still very ignorant and finds it difficult to connect ultimate effects with long distance and cumulative causation.

The capable engineer-doctor should protect his patrons from all evil influences which may have an ultimate evil effect, the ultimate evil depressive influences of defective supplies of oxygen, and non-aerial dilution of volatile excretory matters from the human body or from any other organic decompositions.

IMPORTANCE OF BEING GUIDED BY OUR SENSES.

The fact that we cannot mathematically weigh or otherwise compute these matters in foul air is no evidence that they do not exist. We must base our theory as to their nature and presence upon the results produced by their influence. We can smell and taste and feel influences as to which we have no other method of computation, and if anyone insists that these undefinable matters do not exist or are not deleterious, why is it that one feels immediately the influence of air surcharged with the respiration of many human beings, such as is experienced when one enters the subway cars and before any mere influence of heat or moisture on the body can be exercised? Even in heated and depressive atmospheric conditions, the depressing influence is probably due to the interference with quick transportative interchange of carbon dioxide and oxygen in the respiratory effort.

One may breathe very hot air without experiencing discomfort, if the air is pure, or very moist air, if the air is pure, for a considerable time without experiencing discomfort. One may be subject to great heat, as in a hot water bath, for a long time, if one is breathing pure air.

So long as the world is so ignorant as to unknown influences which affect our bodies for good or evil, we are not justified in coming to definite conclusions in regard to those possible, but not understood, influences; and this, it seems to me, should be applied in this matter of ventilation.

We should breathe clean, fresh air, having normal constituents as to its best proportions of oxygen to develop our best activities. Other things being equal, the more oxygen we have in the air we breathe, the stronger we are to accomplish the activities of life.

Compressed air means more oxygen to breathe. A diffused induced draft means oxygen diffusion. Hence a plenum draft induces more vital activity than the exhaust draft, and the person working at the sea level is capable of greater activities than the person working at higher levels. This is apparently due to the fact that every respiratory effort succeeds in utilizing a larger amount of oxygen. It is certain that various excretory volatile matters from the human body produce nausea, loss of appetite and other disturbances, and if that result is commonly to be observed, we have no right to say that there are not injurious matters in poor air other than heat, moisture and lack of movement.

Heat From Radiators Under Different Temperatures

By Charles A. Fuller.

The subject of the rate of transmission of heat from radiating surfaces under different temperatures is one of considerable importance when a room temperature other than 70° F. is to be maintained, or when high pressure steam is to be used. The transmission factor for cast-iron radiation generally used is 250 B. T. U. per square foot per hour and 300 B. T. U. per square foot for pipe coils and wall radiation. The required room temperature for nearly all classes of buildings is 70° F., with a few exceptions, such as factory buildings, foundries and store rooms which are frequently figured on a basis of 40° F. to 60° F., as the case may require. Dry rooms may be estimated at a temperature of from 90° F. to as high as 160° or 170°, depending upon the class of material handled.

For low pressure steam heating the average temperature of steam in the radiator is approximately 220° F. For convenience sake, we will designate the average temperatures dealt with, namely, room temperature 70° F. and steam temperature within the radiator 220° F., as "standard conditions." Under these conditions, the "standard temperature difference" would be 220—70=150° F. Assuming that the average cast-iron radiator gives off 250 B. T. U. per square foot, the rate of transmission would be 250÷150=1.67 B. T. U. per square foot per degree difference per hour.

TRANSMISSION FACTOR DOES NOT REMAIN CONSTANT FOR ALL TEMPERATURE DIFFERENCES.

It is generally assumed that this factor remains constant for all differences in temperature between the inside and outside of the radiator and the total transmission for other than the standard difference of 150° determined from this factor. To illustrate, assume that the same radiator as mentioned above is placed in a room the temperature of which is 100° F. instead of 70°. The difference in temperature between the steam and the room would be 220—100 =120°.

The usual method of procedure in determining the total heat given off from 1 sq. ft. of radiating surface under these conditions would be to multiply the temperature difference of 120° by the rate of transmission under standard conditions; namely: 1.67, giving a total transmission of 200 B. T. U. per square foot. We have no right to assume, however, that the factor of 1.67 remains constant for varying differences of temperature. Various tests which have been made indicate that it does vary directly with the change in temperature, that is, as the temperature difference increases, the rate of transmission increases.

The principal reason for this is undoubtedly due to the fact that as the difference in temperature between the inside and outside of the radiator increases, the air surrounding the radiator flows up over the surface at a higher velocity, which naturally increases the rate of transmission per degree difference.

COMPARISON OF VARIOUS TESTS AND TABLES.

In an attempt to establish some definite law for this variation the writer has taken the records of various tests and tables from several books and compared the results. The first table given below is taken from Allen's "Notes on Heating and Ventilation." The succeeding ones are from Carpenter's "Heating and Ventilating Buildings."

The first column in each of these tables gives the difference in temperature between the steam in the radiator and the room temperature in which the radiator is placed.

The second column gives the transmission factor, or transmission in B. T. U. per degree difference per hour. It will be noted that in each of these tables this factor increases as the temperature difference increases, for the reason as stated above.

The temperature difference of 150° is taken as the normal or standard con-

TABLE 1

Temperature difference.	B. t. u. per degree difference.	Percentage of variation per degree.
80	1.425	0.220
90	1.455	0.210
100	1.485	0.216
110	1.515	0.250
120	1.550	0.230
130	1.590	0.225
140	1.635	0.180
150	1.665	....
160	1.710	0.270
170	1.745	0.240
180	1.770	0.210
190	1.815	0.250

TABLE 2

Temperature difference.	B. t. u. per degree difference.	Percentage of variation per degree.
50	1.29	.213
60	1.33	.209
70	1.36	.212
80	1.40	.209
90	1.43	.213
100	1.47	.208
110	1.51	.198
120	1.54	.205
130	1.57	.180
140	1.61	.200
150	1.64	....
160	1.66	1.30
170	1.69	1.35
180	1.72	1.50
190	1.75	1.57
200	1.78	1.60

TABLE 3

Temperature difference.	B. t. u. per degree difference.	Percentage of variation per degree.
50	1.54	.206
60	1.58	.210
70	1.63	.199
80	1.67	.197
90	1.72	.189
100	1.76	.186
110	1.80	.180
120	1.84	.140
130	1.88	.160
140	1.91	.150
150	1.94	....
160	1.97	.160
170	2.02	.205
180	2.05	.193
190	2.09	.195
200	2.12	.186

dition. The writer then gives, in the third column, the variation of the transmission factor in percentage for each degree of variation from the standard.

To illustrate, take the factor of the temperature difference of 130° given in the first table. The factor for this difference is 1.59. The factor for standard conditions is 1.67. To find the percentage of variation: $1-(1.59\div1.665)=0.045$ or 4.5%.

This is taken for 130° difference, which is 20° below the standard 150°. The variation is therefore 4.5% for 20° F., or 0.225% per degree. The percentages for the other differences are determined in the same manner and are recorded in the third column of each table.

It might be noted here that the important point in this particular investigation is not the rate of transmission for any particular radiator or heating surface, but a method of determining the variation of this rate under different conditions and thereby establishing some law or rule which will apply to all cases.

It will be noted from an examination of the three tables that the percentage of variation is nearly constant throughout the entire range. The average of all of the above results shows that the variation is approximately 0.2% per degree or 2% for each 10° above or below the standard difference. This would indicate that for all practical purposes it would be sufficiently accurate to assume 0.2% per degree as the variation in the transmission factor for all surfaces.

Having established this percentage of variation it is now possible to determine the total B. T. U. transmission for any radiator, coil or heating surface, for all steam and room temperatures. To illustrate the application of this, assume a pipe coil placed in a room which is to be heated to a temperature of 120° F., the steam temperature in the coil to be 230°F. What would be the B. T. U. transmission from the pipe coil per square foot?

The difference in temperature in this case is 230—120=110° F. Under the "standard" difference of 150° the coil would transmit 300 B. T. U. per square foot or $300\div150=2$ B. T. U. per square foot per degree difference per hour. Under the assumed conditions, the difference is 150—110=40° F. below standard. From the conclusions arrived at, as stated above, that the factor decreases 0.2% per degree, the decrease would be 40×0.02 or 8%. $2\times0.08=0.16$, the amount of decrease in the factor.

$2-0.16=1.84$, the transmission factor under the assumed conditions.

$1.84\times110=202.4$ B. T. U. per square foot given off from the coil.

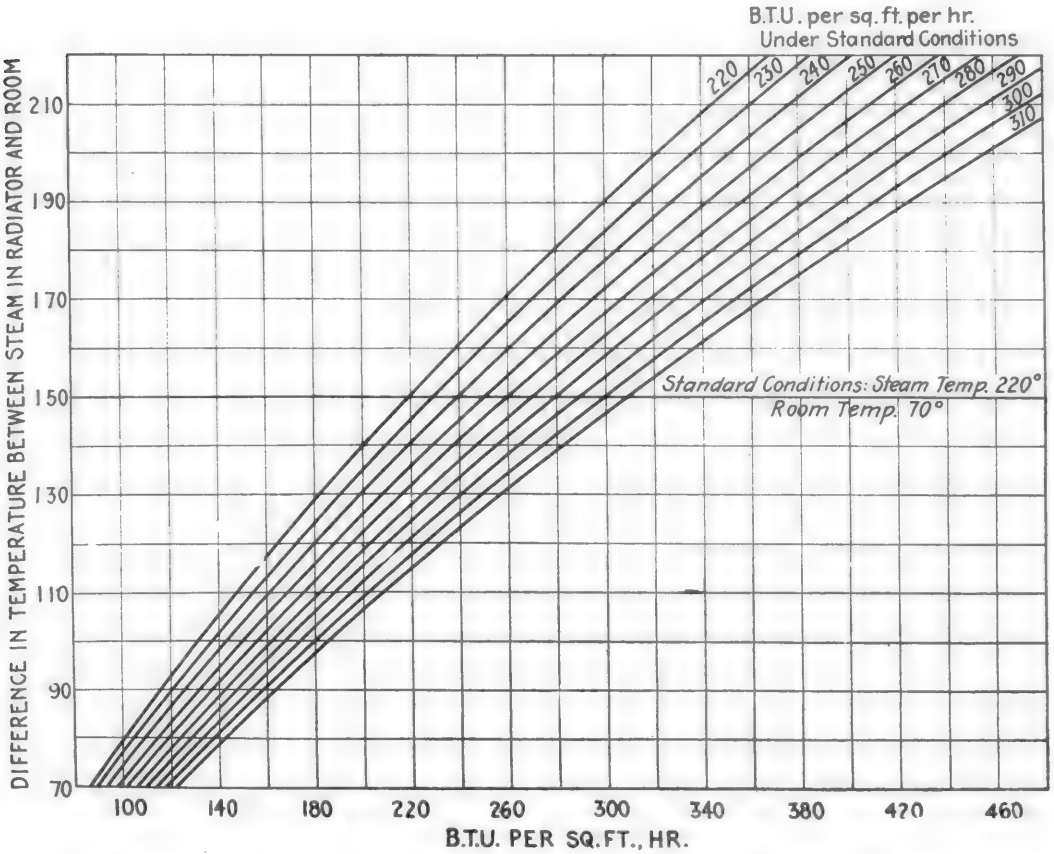
This same method of procedure should be followed when the difference in temperature is above 150° with the exception that the amount of variation is added to the factor instead of subtracted, as above.

USE OF CHART FOR SIMPLIFYING CALCULATIONS

In order to eliminate the necessity of going through the computations for each specific case, the writer has plotted a set of curves, shown in the accompanying chart, which simplify the work. At the left hand side of the chart is given the difference in temperature between the steam in the radiator and the room temperature. The figures at the bottom of the chart indicate total B. T. U. transmission per square foot of heating surface per hour. The curves shown are for various types of radiators and radiating surfaces, and the figures by which these curves are designated, given at the upper right hand side of the chart, represent the B. T. U. transmission per square foot per hour under standard conditions. Pipe coils are estimated to transmit 300 B. T. U. per square foot, as previously stated, and therefore, if it is desired to determine the transmission under other than standard conditions, the 300 B. T. U. curve should be used.

Let the problem given above be solved by means of the curve. The steam temperature was 230° F. and the room temperature 120° F. or the difference was 110°. A pipe coil was used, therefore the 300 B. T. U. curve should be referred to.

At the left side of the chart find the point corresponding to 110° difference.



HEAT TRANSMISSION FROM RADIATING SURFACES WITH VARYING DIFFERENCES IN TEMPERATURE BETWEEN STEAM IN RADIATOR AND ROOM.

From this point follow a line horizontally to the right until it intersects the 300 B. T. U. curve. From this point of intersection follow a line vertically to the bottom of the chart and the point is found to lie at the 202 B. T. U. point which checks with the results obtained above.

Another application of the curves would be in such cases where a building has been heated with high pressure steam and it is desired to change to ex-

haust or low pressure steam. The curves may be used to determine how much additional surface must be added.

Assume that a certain room has 200 sq. ft. of surface which has a transmission of 250 B. T. U. per square foot under standard conditions. The system is operating under a pressure of 40 lbs. per square inch and the amount of surface in this particular room is just sufficient to maintain a temperature of 70° F. in zero weather. How much additional surface must be added if the pressure is reduced to 2 lbs. and the temperature to be maintained as before?

Steam temperature corresponding to 40 lbs., 286.5° F., 286.5—70=216.5° F. difference.

The 216.5 line is found to intersect the 250 B. T. U. line at the 410 B. T. U. point. The radiator, therefore, gives off 410 B. T. U. per square foot.

200×410=82,000 B. T. U. necessary.

82,000÷250=328 sq. ft. necessary under new conditions.

328—200=128 sq. ft. that must be added. The accompanying table, taken from the writer's text book on "Designing Heating and Ventilating Systems" gives the transmission of various types of radiators under standard conditions. This table used in connection with the chart should fulfill nearly all conditions met with in heating work.

Type of Radiator	—Height of Radiator.— 22-in.	26-in.	32-in.	38-in.
1 column	1.90	1.86	1.83	1.80
2 column	1.80	1.75	1.71	1.67.
3 column	1.70	1.65	1.60	1.54
4 column	1.60	1.55	1.50	1.45
Window radiator				1.85
Pipe coils				2.00
Wall radiator (horizontal)				1.95
Wall radiator (vertical)				1.90

An Experiment With Ozone as an Adjunct to Artificial Ventilation

By A. M. Feldman.

(*Presented at the annual meeting of the American Society of Heating and Ventilating Engineers, New York, January* 20, 1915.)

Another successful run during the summer of 1914 has been made of the cooling and ventilating plant in the small ward of the Mt. Sinai Hospital, New York. This plant was installed for the purpose of treating gastro-enteritis diseases of children. Although the success with which it was used in the summer of 1913 directly following its installation, was highly satisfactory, its usefulness was considerably augmented by the addition of an ozone machine the past summer.

The plant, as it has been described in a paper presented by the writer before this society at its annual meeting of 1914 (published in The Heating and Ventilating Magazine for February, 1914), was designed to deliver a sufficient quantity of fresh, cleaned and cooled air, for an average of three small children. This equals about 250 cu. ft. per minute. The vitiated air is allowed to escape through two open window transoms.

Notwithstanding the quantity of fresh air supplied there always has been a decidedly unpleasant odor due to the character of the periodical discharges by the children under treatment. The writer felt that an attempt to eliminate this odor by means of an augmented delivery of fresh air would have been prejudicial to the safety of the children and nurse in charge on account of draughts and aside from this objection, the cooling machine would have proven inadequate for cooling the increased amount of air.

The writer, therefore, thought it would be a good opportunity to test the efficacy of the claim being made for ozone as a neutralizer of odors. Through the kindness of the Hudson Ozone Machine Co., which volunteered to furnish the writer with some of its small machines, the experiment to which refer-

ence is made, was accordingly undertaken. The machine was placed at the end of the room farthest away from the fresh air register—near the window. The small fan in connection with this type of machine was removed to prevent the causing of draught by the violent movement of the cool air.

It is gratifying to the writer to be able to report that the experiment proved a success. That the use of ozone has neutralized the odor above referred to, has been attested to by the nurse in charge, and by the attending and visiting physicians. It was especially marked when, on a few occasions, the ozone machine got out of order. The nurse was then very anxious to get it back into use, as she had been rendered more strongly susceptible to the odor by its very absence.

This single personal experience has satisfied the writer of the fact that there is merit in the claim for ozone as an adjunct to artificial ventilation in cases where objectionable odors are being constantly generated.

District Heating

By S. Morgan Bushnell and Fred. B. Orr.

III—Velocity Steam Meters and Water Meters.

THEORY OF VELOCITY STEAM METERS.

Referring again to the fundamental equation,

$$W = A \times d \times V \times K \quad \ldots\ldots\ldots\ldots \quad (1)$$

We find that a different solution is possible than that arrived at as the basis of area meters; namely, that we may assume a certain orifice or area of constant cross-sectional area "A," and allow the changeable steam flow to be measured in terms of the resultant variation in velocity. This law forms the basis of the so-called velocity meters. The basic principle of velocity meters is, in the last analysis, not essentially at variance with the area meter, since there is involved in either the element of pressure differential. This type, however, embodies the application of the well-known idea of the pressure equivalent of velocity which is familiar to engineers generally, as exemplified by the Pitot-tube, Venturi-tube, throttling disc and modifications thereof.

PITOT-TUBE.

The Pitot-tube was first used by the inventor Pitot, about 1837, for the measurement of water in pipes. Since then it has been applied to other liquids and gases, and finally to measuring steam flow. While there are numerous modifications of the original design the principle remains the same. To illustrate, in Fig. 5, let A-B represent a pipe or conduit through which water flows with a velocity "v" feet per second. Insert two open tubes into the pipe as shown, one marked "D," having its opening pointed against the flow "V"; the other tube S, having its opening at right angles to the flow. The tube S is known as the static-tube, and at all times is subjected only to the pressure due to the static condition. In other words, it is independent of the velocity (neglecting for the moment the slight aspiration or suction effect). The tube D, known as

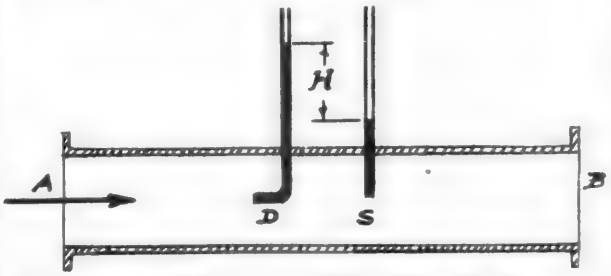


FIG. 5—DIAGRAM ILLUSTRATING PRINCIPLE OF PITOT TUBE.

the dynamic-tube, is also subjected to the static pressure, and under no flow conditions this pressure will equal that of the static tube. When a velocity is created, however, the dynamic-tube receives the impact of the moving particles of fluid in addition to the static pressure and thus water will rise in the tube "D" to a height (H) above the level in the static-tube, upon which, as we have just observed, the impact has no influence. The height (H) is an ex-

TABLE I.—CLASSIFICATION OF STEAM METERS.

		Primary Element	Secondary Element	Inventor or Maker		
Area Meters. (Velocity constant.)	Series type.	Floating Valve	Mechanical control, clock and chart.	St. John	1893	†o
				Gehre	1896	†o
				Baeyer	1902	†o
				Bendeman	1902	†
				Sargent	1908	†
				Lindmark		†
				Rhenania	1910	†o
Velocity Meters. (Area constant.)	Shunt type.	Impeller in current of steam	Gears and dials	Lindenheim	1896	*
				Gebhardt	1908	*
	Series type.	Pitot tube	Mercury manometer	General-Electric	1910	†o*
				Republic	1914	†o*
				Bristol	1912	†o
			Water manometer	Burnham	1906	
				Gebhardt	1910	†
		Stationary or throttling disc.	Mercury manometer	Halwachs	1907	†o*
				Gehre	1907	†o
				Sarco	1910	†o*
				Storrer	1910	†o
		Venturi tube	Bourdon manometer	Eckhardts	1903	†o
			Mercury manometer	Bristol	1911	†o
			Mercury manometer	Parenty	1886	†o
				Herschel	1910	†o*
		Impeller in current of steam	Gears and Dials	Holly	1880	*

† Indicating. o Recording or Autographic. * Integrating.

act mathematical function of the velocity V, being the potential equivalent of the kinetic energy due to the velocity. The mathematical relation of these phenomena is represented by:

$$V = \sqrt{2gh}; \text{ or } h = \frac{V^2}{2g} \quad \ldots\ldots\ldots (3)$$

where V = Maximum velocity of flow in feet per second.
h = Difference in level in feet of water column.
g = Acceleration of gravity = 32.2 feet.

The foregoing will be understood as applying only to the flow of water. When it is attempted to measure velocity of steam and other gases by this method more complicated calculations are necessary. The reason for this lies in the substance used in the tubes to indicate the unbalanced pressures. Water is not a satisfactory agent for accomplishing this, and oils and mercury columns have been employed, the latter having proven the most successful. Thus the simple equation given must be elaborated so as to consider the different densities of the flowing and the indicating substances. If mercury is used instead of water, to indicate the velocity the solution is as follows:

$$Hw = Hm \times \frac{dm}{dw} \quad \ldots\ldots\ldots\ldots\ldots (7)$$

in which,

Hw = Height of water column.
Hm = Height of mercury column.
dw = Density of water.
dm = Density of mercury.

Substituting in (3) we have—

$$V^2 = 2g\left(Hm \times \frac{dm}{dw}\right) \quad \text{or,}$$

$$V = \sqrt{2g \times \left(Hm \times \frac{dm}{dw}\right)} \quad \ldots\ldots(8)$$

$$\sqrt{2g \times \left(Hm \times \frac{13.6}{1}\right)}$$

$= 29.6\sqrt{Hm}$, feet per second.

This value when substituted in (1) gives the quantity of fluid flowing per unit of time. This formula, as will be seen later, applies to the various other types of velocity meters, including the Venturi. The above considerations are theoretical, to be sure, but actual practice agrees approximately with the results given. By substituting proper values for density, we may in a similar manner compute the flow of steam, using either water or mercury indicating columns, since each is heavier than the measured substance.

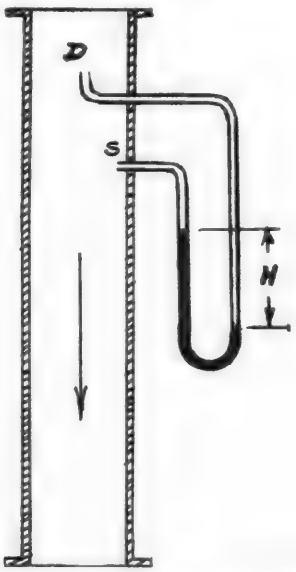
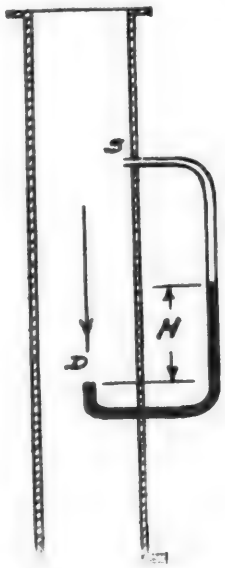


FIG. 5A—ACTION OF PITOT TUBE, SHOWING UNBALANCED PRESSURES.

Unsuccessful attempts to introduce the impeller type of meter stimulated activity in other lines leading to the experiments of Burnham, 1906*. The earliest and most primitive form experimented upon consisted simply of a Pitot-tube leading into a common gauge glass, shown in Fig. 6.

It is needless to say that these never attained importance until greatly modified and improved upon. By constant experimentation this meter has evolved from the crude design shown above to the form known as the Clyde or Gebhardt steam meter, which is now one of the very few meters employing water as the indicating substance. This meter is the most inexpensive meter to be obtained, but as its use is limited to the indicating feature exclusively, it is employed only for testing purposes.



FIB. 6—USE OF PITOT TUBE AS WATER MANOMETER.

GEBHARDT INDICATING METER.

This meter, shown in Figs. 7 and 8, solved the difficulties of the water manometer type and perhaps it will be of interest to describe it in detail, as one of the few commercial devices now in common use.

The steam when first introduced through the dynamic tube into the dynamic chamber at the bottom condenses, forming water entirely out to the tips of the tube, which is provided with a number of small openings at right angles to the flow; both tubes being built together,

*Armour Institute of Technology.

and inserted through the wall of a steam pipe in very simple manner. When no steam is flowing in the pipe, the condensation will rise only to the height of the dynamic tube, giving a zero reading, but when steam is flowing the column of water rises as a result of the unbalanced differential, as has been explained before. If we measure the height of the water column, at any instant, we have again approximately,

$$\frac{V^2}{2g} = Hw.$$

And since we are now dealing with steam as a flowing substance, instead of water as in equation (3) we have,

$$\frac{V^2}{2g} = Hw \times \frac{dw}{ds} \quad \ldots\ldots\ldots\ldots\ldots (9)$$

where dw = density of water in pounds per cu. ft.
ds = density of steam in pounds per cu. ft.

The solution of (9) results as follows:

$$V = \sqrt{2g \times Hw \times \frac{dw}{ds}} \quad \ldots\ldots\ldots (10)$$

$$= \sqrt{2g \times dw \times \frac{Hw}{ds}}$$

$$= \sqrt{2 \times 32.2 \times 59.76 \times \left(\frac{Hw}{ds}\right)}$$

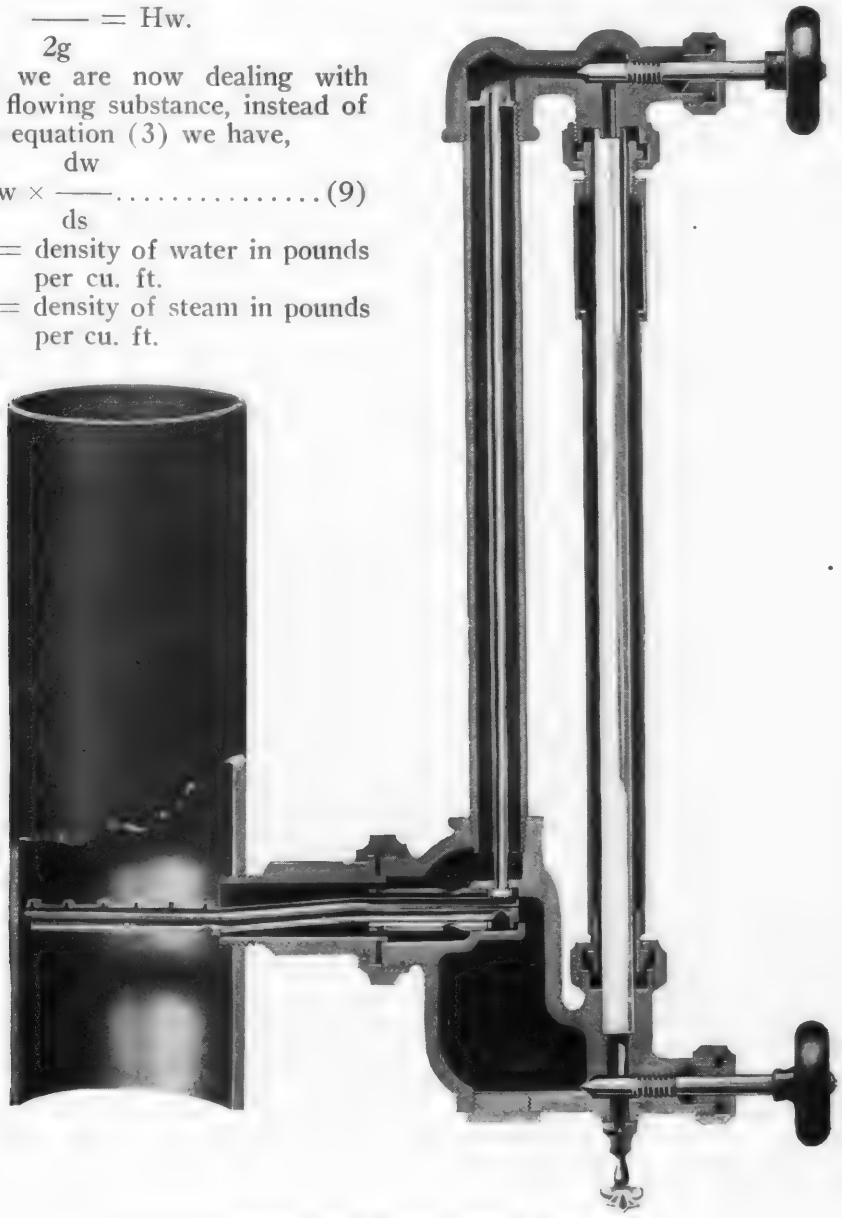


FIG. 7—GEBHARDT INDICATING METER.

$$= 62.04 \sqrt{\frac{Hw}{ds}} \text{ feet per second.} \quad (11)$$

Equation (11) represents the maximum velocity of the flowing steam. It is well known that the velocity diminishes near the edge or inside surface of a pipe due to friction; therefore, the point of mean average velocity for the section will be found somewhere between the maximum (at the center) and the wall of the pipe. This factor, which we will call K must be determined by experiment for each size pipe. The mean velocity then becomes,

$$V = 62.04 \times K \sqrt{\frac{Hw}{ds}} \text{ feet per second..} (12)$$

After determining the velocity as above the value may be substituted in the formula,

$$W = A \times d \times V \times K \ldots\ldots\ldots\ldots (1)$$

Then,

$$W = A \times ds \times 62.04 \times K \sqrt{\frac{Hw}{ds}} \text{ lbs. per sec.}$$

$$= A \times 3600 \times 62.04 \times K \sqrt{(Hw.\ ds)} \text{ lbs. per hr.}$$

$$= 223344 \times A \times K \sqrt{(Hw \times ds)} \quad (12)$$

Formula (12) is the equation used for computing the charts, furnished with the meter. These charts, as will be seen, are mounted upon a cylinder placed at the side of the water glass, and are graduated to read in pounds of steam per hour directly.

Before leaving the subject of velocity meters, it will be well to consider the Venturi tube, and its application to the measurement of water and steam.

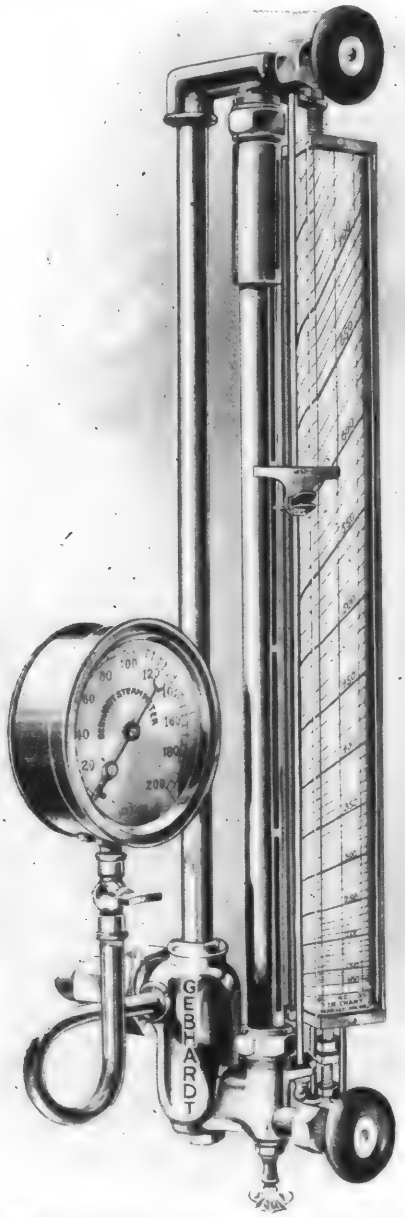


FIG. 8—GAUGE AND INDICATOR OF GEBHARDT METER.

VENTURI-TUBE.

The phenomena described below was first observed by the Frenchman, J. B. Venturi, in 1791. He did not recognize the utility of the principle he had discovered and made no use of it. It remained for Clemens Herschel, almost a century later (1887), to apply this knowledge in a practical way. The result is the Venturi meter, which has been used very extensively since that time for measuring water. The meter has since been modified for the purpose of metering other liquids and gases, including steam. Fig. 9 illustrates the principles governing the action of the primary element or tube, and Fig. 10 shows the secondary element attached.

A fluid flowing through a Venturi tube must pass the contraction B at a greater velocity than at A. After passing the point B, the velocity due to the suction effect of the expanding nozzle, returns to the normal with only a perceptible loss in pressure at C. The increased velocity at B results in a lowering of the pressure at that point, and if

a differential manometer is connected between A and B, the difference in the heights H, of the two columns will be a measurement of the velocity of fluid. This height will increase approximately as the square of the throat velocity,

FIG. 9—DIAGRAM OF VENTURI TUBE.

$V^2 = 2\,gH$; if the velocity is doubled therefore, the height will be four times as great. Therefore,

$$W = K. \times A \sqrt{2\,gH} \ldots\ldots\ldots\ldots (13)$$

Where W = Quantity flowing per second.

K = Experimental constant which has been found to be within 2 per cent. above or below 0.98 for water at average velocity.

A = Area of throat of tube in square feet.

H = Head in feet corresponding to the difference in the pressure of the fluid entering the tube and the throat.

The Bernouilli theorem applies also in the case of the Venturi tube. A portion of the static pressure head at A is converted temporarily into dynamic velocity head through the throat B. The function of the downstream (discharge) nozzle is to regain the changed energy of the pressure head through a lowering of velocity. This is done with only slight permanent loss of pressure.

It is evident that the high ratio of contraction in area at the throat will produce relatively large differentials between B and C. This renders it necessary to use a mercury manometer, and with extremely high velocities the difference in level produced when measuring water will be as high as 22 in. corresponding to a differential of $22 \times 0.4908 = 11.8$ lbs. per square inch.

Thus it will be seen that the facility of accurately reading the manometer levels or of automatically communicating same to recording devices is greatly enhanced by the great range of measurement as compared with the much lower differentials obtained by the Pitot-tube. This difference is somewhat reduced, of course, for steam flow due to the lower density of steam.

The coefficient of this instrument at average load is 98 per cent. At low velocities the coefficient is greater and at high velocities lower, varying through the guaranteed range by not more than 2 per cent above or below. The Venturi water meter is extensively used for boiler feed water service, and if care is observed in selecting a tube of proper proportions, it gives very satisfactory results. The accuracy is questionable below 8 per cent. of the maximum rate of flow, and the meter will under-register. As a steam meter, it is probably to be recommended only for superheated steam, as moisture will affect the accuracy to a great extent.

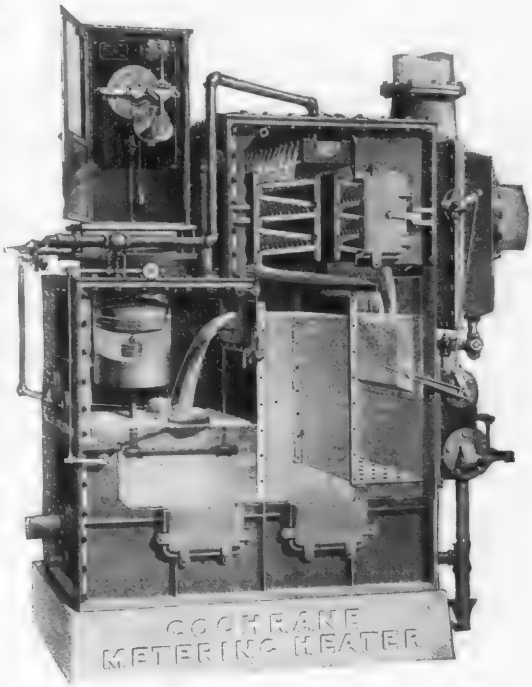
WATER METERS.

Several methods are available for metering the boiler feed supply. These are:

(a) *Displacement Meters,* consisting of:

(1) Revolving vanes or discs, and

(2) Reciprocating plungers or pistons, geared to dials which record the volume in suitable units: viz.: cubic feet or gallons.



COCHRANE "V-NOTCH" WEIR WATER METER FOR BOILER FEED.

(b) *Velocity Meters,* operating on the well-known principle of the Pitot tube or Venturi tube and registering velocities through appropriate mechanical manometer devices.

(c) *Weir Meters,* consisting of floats for automatically gauging the height of a stream of water flowing over or through various forms of outlet, or orifice, e. g., the "V-Notch," "Yorke" and other forms of weirs.

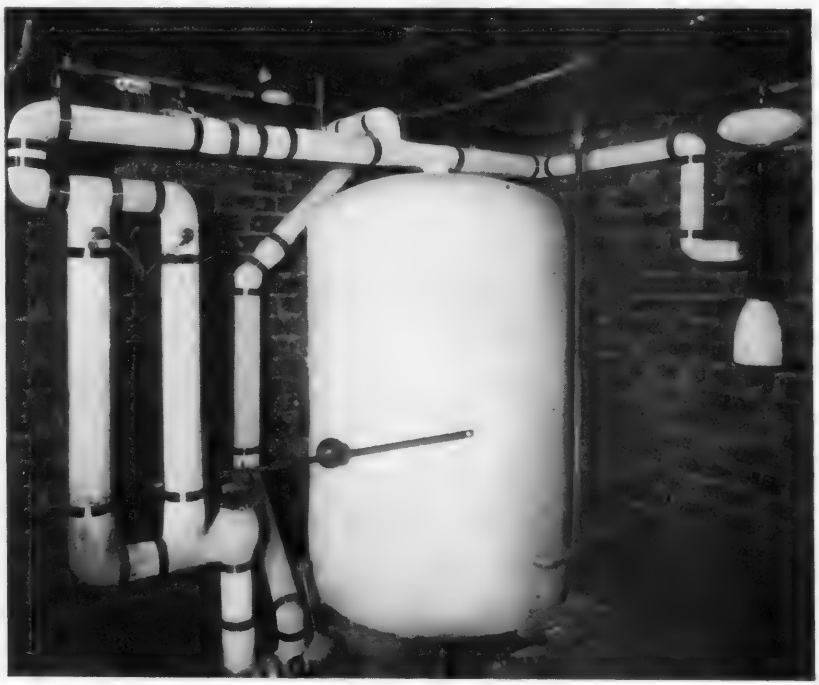
(d) *Gravity Automatic Weighers,* consisting of chambers or compartments which alternately fill and discharge, differing only in function from the condensation meter.

In the next article the authors will continue the discussion of meters, taking up the condensation type, meter defects and general conclusions.

Further Developments of Electric Heating in Seattle.

Referring to the description published in the January issue of the use of electric heaters in Seattle for the heating of residences, further tests of these heaters made by the Lighting Department of Seattle, of which are here presented in greater detail than in the January issue, these heaters are arranged exactly like a hot water boiler in the ordinary hot water heating system, and, in fact, may be used in conjunction with a hot water boiler.

The four-unit heater, as shown, is con-



TWO 4½-K.W. ELECTRIC WATER HEATERS, WITH 180 GAL. STORAGE, WHICH SUPPLY 250 SQ. FT. OF DIRECT RADIATION.

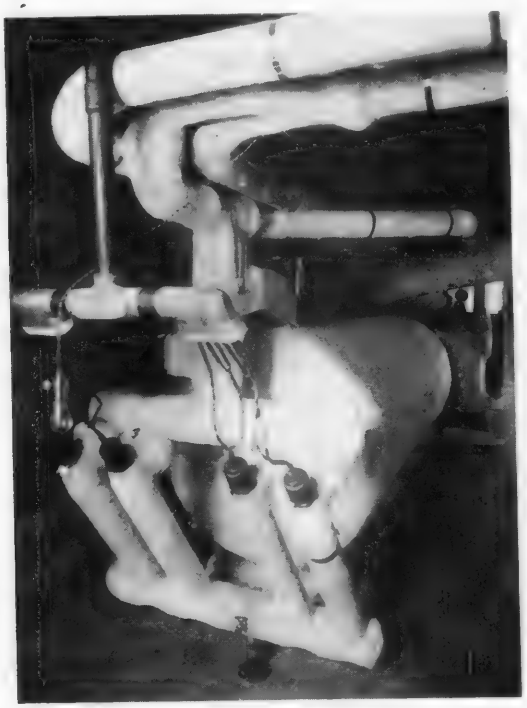
which J. D. Ross, E. E., is superintendent, have revealed the fact that the hot water heating system is the only one that is practicable on account of the fact that it is necessary to cut off the current during the hours of lighting peak.

As will be seen from the illustrations, trolled by a thermostat in the return pipe which automatically cuts off the return when the return water reaches a certain temperature.

In figuring the size of an electric heater, the department has found that 1 K. W. capacity for 20 sq. ft. of radiation is the

right proportion for the climate of Seattle. Probably in a more severe climate, 1 K. W. for 15 or 18 sq. ft. of radiation should be allowed.

With a lighting peak of 4½ hours experience has shown that 20 gal. of storage for each kilowatt of energy is needed. As noted in the report, the actual cost for



FOUR 10-K.W. ELECTRIC WATER HEATERS, WITH 800 GAL. STORAGE, SUPPLYING 690 SQ. FT. OF DIRECT RADIATION.

The storage capacity enables the heater to hold over 4½ hours "peak," when current is cut off.

energy runs from 25% to 40% higher than coal in Seattle. It will be observed that with the above factor of 20 sq. ft. per kilowatt and 20 gal. storage per kilowatt, the remainder of the heating system may be figured as an ordinary hot water system. In fact, the only difference in the operation is that the heat obtained is always the same and may be depended upon under all conditions; also, that it may be controlled from a remote point either by switch or by thermostat, or by a time clock.

Tests of Open Air Schoolrooms.

An investigation of the problem of open air schoolrooms is being planned by the New York Commission on Ventilation, which is expected to definitely determine the relative advantages of open air and mechanically heated and ventilated rooms. The scheme provides for the use of six schoolrooms, each containing the same number of children of the same age, living approximately under the same home conditions; one room to be a closed schoolroom with 68° temperature and the usual closed school regime; a second room to be a closed room with 68° temperature with the open air school regime, another room to be an open air room with the usual open air school regime, another room to be an open air room with the standard closed schoolroom regime, another room to be a closed room with 50° temperature and the closed schoolroom regime, the remaining room to be a closed schoolroom with 50° temperature and the open air schoolroom regime. The 50° temperature in the last two rooms would be continued only as long as outside weather conditions would permit. It is believed that such an investigation will give a great deal of valuable information on this important subject of open air schoolrooms.

Space Requirements for Heating and Ventilating Plants.

An extensive study of the space requirements for ventilation plants has been made, under the direction of the author, in connection with forty school buildings, with the result that it has been found that approximately 1¼ sq. ft. of floor area is required in the boiler room per 1000 cu. ft. of contents of the building, with approximately the same allowance for fuel supply. The space required for the fresh air plant, that is, the fans, heaters, air washers, motors, etc., varies from 1 sq. ft. to 1½ sq. ft. per 1000 cu. ft. of space in the building, while the space required for the exhaust air plant is approximately half of that required for the fresh air plant. The height of these spaces depends upon the size of the building and its apparatus, varying from 7 to 14 ft. for the fan rooms and from 12 to 20 ft. for the boiler rooms. Usually the floor of the boiler room must be from 2 to 8 ft. below the level of the floor of the fresh air heater rooms, unless vacuum heating systems are used.

The usual size of the fresh air and exhaust flues for each standard 40-pupil classroom is found to be 4 sq. ft. in area in both the fresh air and vent flues, although a number of systems are designed with 3 sq. ft. of fresh air and vent flue area each. These areas are increased or decreased as the number of pupils per room is increased or decreased—D. D. Kimball in the School Board Journal.

THE HEATING AND VENTILATING MAGAZINE

Vol. 12 March, 1915] No. 3

PUBLISHED MONTHLY BY THE

Heating and Ventilating Magazine Co.

1123 BROADWAY, NEW YORK

A. S. ARMAGNAC.....*President*
GUSTAVE PETERSEN....*Secretary and Treasurer*

A. S. ARMAGNAC, Editor
GUSTAVE PETERSEN, Business Manager

European Representative:
W. G. HOLLINWORTH, 304 High Holborn
London, W. C.

Subscription	$1.00 per year
Canada	1.25 " "
Foreign countries	1.50 " "
Back numbers	15 cents each
Back Nos. prior to current year	25 cents each

EVIDENCE is accumulating that a new spirit is spreading among heating engineers bearing upon what may be generally termed the ethics of the profession. This is reflected in such movements as that recently inaugurated in New York to promote professional efficiency and welfare; in the forthcoming promulgation of detailed suggestions for minimum heat and ventilation requirements applicable to various classes of buildings, and, finally, in the attitude of individual engineers whose feelings on the subject, we believe, are given adequate expression in the article in this issue bearing on the relation of the architect and the engineer.

The part to be played by an approved set of requirements for heating and ventilating buildings as affecting engineering ethics has not, perhaps, been given as much consideration as the matter warrants. According to the present plans, these requirements are to be widely distributed among boards of health and other bodies for their special guidance in formulating laws and ordinances in their respective localities. This will no doubt have the immediate effect of raising the question in some cases as to who is the proper authority to determine this point and what part the architect is to play in the matter.

It is becoming increasingly evident that this issue is one that must be decided sooner or later and it is just as well that it should come up over the propriety of an engineering body issuing minimum requirements for the heating and ventilation of buildings. In other words, with the rapid advancement being made in all departments of engineering, the "irrepressible conflict" between the architect and engineer can hardly be postponed much longer.

From the standpoint of division of authority the position of the engineer may be expressed in the statement that "any work the preparation of plans and specifications for which is beyond the ability of the personnel of the architect's staff, independent of advice from a contractor's or manufacturer's engineer, should be consigned to the care of the independent consulting engineer." As to the much discussed question of fees, this may be adequately covered in the statement that "there is no respect in which the work of the engineer is less expensive proportionately than the work of the architect," while the education and training are fully as extensive. Also, "in proportion to the amount of the fee paid to the engineer the cost of the engineer's plans and specifications is quite as great as the cost of the plans and specifications of the architect. . . . Why, then, should not the engineer be paid as high a rate as the architect?"

These two attitudes will appeal to many as a safe working basis and one upon which engineers may take their stand.

THE CONSULTING ENGINEER

The Consulting Engineer" is prepared to reply, in this department, to any questions which our readers may ask regarding problems connected with the design and installation of mechanical equipments of buildings.

42—Time Element in Heating a Building.

QUESTION: Which takes the longer time to heat a building, a steam or hot water apparatus?

ANSWER: The time element in a heating apparatus, whether steam or water, is only limited by the boiler power and size of main. There are few buildings where the boiler power is provided in excess of the usual requirements on a zero to 70° F. basis. Under such conditions it will take a long interval to heat the building and it becomes practically impossible to heat it to 70° from below 40°, if it is zero outside during the interval. If higher steam pressures and temperatures are used on the radiation, the boiler power is increased accordingly. This is readily seen as the radiation is generally provided to supply heat in the case of steam at 215° temperature with the room at 70°. If the room were down to 40°, with zero outside, the radiation would give off, according to a difference of 215 — 40, 175° F., instead of 145°.

For each increment in temperature given the room and contents, another increment has to be provided to maintain the increased loss to the outside (the amount supplied the room is getting continually less and that to the outside is constantly increasing). Suppose it was in the proportion given by the factors 175 and 145, a difference of 30, as one increment is required to raise the room temperature and one to maintain it, the increased radiation to the outside, the real increase, would be only about 15° or 55°, or the point at which the radiation and temperature balanced the losses to the outside. Of course, if an infinite time were allowed, it would nearly reach the 70° mark.

Another point seldom considered is the amount of heat absorbed by the cast-iron radiator which has 7 lbs. per square foot, with a specific heat of 0.13. This means 0.91 B.T.U. absorbed per degree raise per square foot, before the radiator will perform its function. This is given back again at some future time, but at a loss, as it generally is utilized to overheat a room after the windows are opened to cool it.

When the radiation temperature is raised sufficiently, the time may be shortened, but this means higher pressure, increased pressure drop on the mains and correspondingly greater boiler power.

There is a radical difference in the action of steam and hot water apparatus in starting. As the steam is 212° or more, all radiators, cast-iron, etc., have to be heated to that temperature before heat is given to the room. The number of sections heated in a given time will be in accordance with the boiler power provided. The maximum heating effect will be given off with a low temperature of the room at the start, delaying the time of heating the last radiator on the line which will receive no steam until boiler power is available, due to a raise in temperature of the air about the first section or section of rooms, reducing the steam consumption.

Hot water, on the other hand, has its minimum heating effect at the start, due to the water and room temperature being the same, and heat is not transmitted from the radiator until the water is heated above the room temperature. Therefore, the time may be the same as the steam, but all radiators will be heated nearly at once and some heat will be transmitted to the end of the line.

This is more or less of a theoretical discussion of the action of the two systems and the points would not be brought out unless a building were allowed to get to a low temperature in extreme weather. This, however, has occurred in some cases and it has been proven that with the ordinary system installed to provide for 70° in zero weather, the building did not get warm until the weather moderated without.

It will be found in practice if an economical system is installed, whether steam or water, that it will be much cheaper to maintain the heat continuously than intermittently. It is acknowledged, however, where a system has a constant temperature of the medium and no automatic heat control, that the overheating of the building through the day requires to be shut down at night to take care of the waste heat which would otherwise go out through open windows.

This discussion refers more particularly to large plants where the boiler power would be appreciable. In small house heating plants, it is generally possible to force the boiler sufficiently to overcome temperature conditions.

43—Loss in Pressure in Rectangular Air Ducts.

QUESTION: Will you kindly give me an authentic formula which will enable me to figure the loss in pressure due to friction in a rectangular air duct? I am desirious oftentimes of knowing pressure losses in very offsize pipe, such as 80 in. x 12 in., or 76 in. x 14 in. Also kindly differentiate between blast and exhaust systems.

ANSWER: In Konrad Meier's book on "Mechanics of Heating and Ventilation," Chart VII, on Page 124, covers the subject of air blast at high velocities. There is also a logarithmic chart published in the back of the catalogue of the American Blower Company in connection with the use of Sirocco blowers. The formulas are as follows:

Pressure in pounds per square foot to create velocity $P_v = 0.075 \frac{V^2}{2g}$

Pressure in pounds per square foot to overcome friction $P_t = 0.075 \times 0.032 \frac{V^{1.9}}{2g} \frac{l}{d^{1.25}}$

$2g$ = acceleration of gravity = 64.32.

V = velocity in feet per second.

l = length in feet.

D = diameter in feet.

The above-mentioned charts refer only to round pipe and the results can be applied to square and rectangular pipes by modifying the quantities by the following factors:

Ratio sides: $1 \times 1 = 1.15$; $1 \times 2 = 1.23$; $1 \times 3 = 1.36$; $1 \times 4 = 1.5$; $1 \times 5 = 1.65$. The formula for the factor is [Periphery of square duct ÷ (diameter round duct same area × 3.1416)]$^{1.25}$

Whether the ventilation is exhaust or blast is only one of difference in pressure drop, except that in the former gravity sometimes assists. Gravity velocities and friction formulas, with charts, are found on Page 142 of Meier's work.

Blowers Damaged by Frozen Lubrication.

Two blowers, used in a foundry to obtain the blast for cupolas, were severely damaged, due to frozen lubrication. These were located in a room seldom occupied, and for this reason the rooms were not furnished with heat. Only one fan was used at a time, the others being held in reserve.

The lubrication was fed automatically to each fan. During a period of cold weather this thickened and failed to properly lubricate the fan bearing which, becoming hot, broke loose and damaged several blades. The foreman not knowing the cause for the accident, threw into service the remaining fan with the same disastrous results. The accident necessitated the closing of the foundry for two days until new fan parts had arrived.

Engine Condensation, with Particular Reference to Exhaust Steam Heating.

One of the subjects that has been much discussed of late is the heat loss in an engine cylinder due to condensation. The matter was brought up at a recent meeting of the New York Chapter of the Heating Engineers' Society, and, more recently, at the annual meeting of the society itself. Papers on the subject were presented by Perry West and David Moffatt Myers, reports of which were published in the February issue.

The following further discussion of the subject has been presented by Mr. West:

"In my discussion of 'Engine Condensation, with Particular Reference to Exhaust Steam Heating,' I was not endeavoring to present anything new in the thermodynamic field, except in so far as the usual method of estimating the amount of engine condensation, due to the work in the cylinder, is concerned. I speak of this theory as differing from usual practice for the reason that I think it will be found that engineers and authors generally assume that the exact heat equivalent of the indicated horsepower of an engine is taken out of the cylinder feed in the cylinder. In other words, I believe that there is a much too generally mistaken idea that the work of admission is done at the expense of heat in the cylinder feed, and that the negative work during exhaust adds heat to the cylinder feed; whereas the only factors of the work which are involved in the condition of the cylinder feed at exhaust are the work of expansion and the work of compression.

"Upon first thought it would seem, according to the law of the conservation of energy, that the net work done in the cylinder should be the exact measure of the heat loss due to work. This would be true, provided there was no work transferred through the steam to the piston from external sources, or from the piston through the steam to external matter during the cycle. Inasmuch as both of these conditions maintain, they must be taken into consideration in the application of this law of the conservation of energy.

"To make this matter clear, I would refer to Fig. 1 where x-x is the axis of zero

pressure and y-y the axis of cylinder volume. BAK represents the end of the steam and ABCDEF an ordinary indicator card. Starting with a clearance space full of feed at initial pressure, steam is admitted along the line BC to the point of cut-off, C, and an amount of work is done, represented by the area, BCHK, which we will call the work of admission. This work is performed on the piston by the steam between the piston and the boiler, acting as a medium for transferring the external work of evaporation from the boiler to the piston. In other words, the

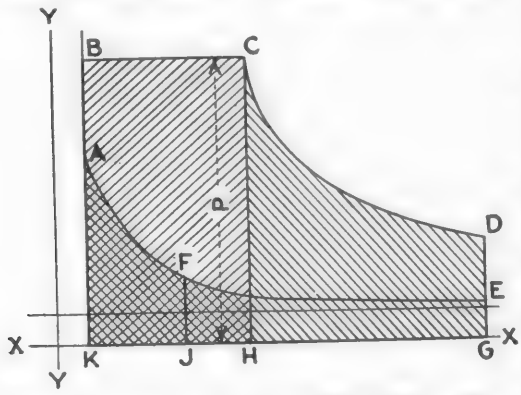


FIG. 1—DIAGRAM ILLUSTRATING MR. WEST'S DISCUSSION OF ENGINE CONDENSATION.

process of evaporation in the boiler is forcing newly generated steam out to take the place of the admission steam and in doing so is performing work against the receding steam, which, in turn, is transferring this work to the piston.

"Practically speaking, no more work is being given to the piston by the steam than is being given to the steam by the external work of evaporation, so that no net work is being taken from the steam itself. There is practically no expansion of compression of the steam and no heat loss due to this work. This can be illustrated in another way by reference to Fig. 2 T is a tank filled with water to a certain level and connected from the bottom to cylinder, C, having a tightly fitted piston, P. L is a supply line which automatically keeps the water in the tank at the same level.

"Now, as the piston moves forward, due to the pressure of water, a certain amount of work is done, but no potential energy is deducted thereby from the water in the tank. The work is simply performed by raising the water to the top of the tank and is put in at that end and taken out at the other and transferred to the pison.

"The water entering the tank may be likened to the newly-generated steam in a boiler, and the water between this and the piston, to the steam between the boiler and the engine piston. In either case, we have a volume of fluid retaining a constant potential energy, but transferring other energy from an outside source to a moving piston.

"After cut-off, expansion takes place along the line CD, Fig. 1, and performs an amount of work on the piston represented by the area CDGH. This work, unlike the work of admission, must come from the cylinder feed itself, since there is no other source in communication with the cylinder from which it might come.

"At D release occurs and a portion of the steam is expelled from the cylinder by virtue of its own pressure being above that of the exhaust. At the beginning of the exhaust stroke, there is a cylinder full of steam at exhaust pressure which must be expelled against this pressure. During this stroke, therefore, there is a certain amount of negative work done, which is sometimes considered as putting heat back into the steam. This is not true as long as the exhaust valve is open, since we have the same conditions as prevail during the admission where work is not done on the

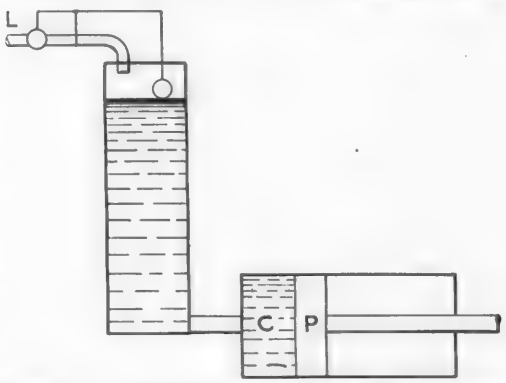


FIG. 2—DIAGRAM OF EFFECT OF WATER PRESSURE ON PISTON.

steam, but through same on some other body. This work ensues without either adding or subtracting heat from the steam until the beginning of compression. During compression the same conditions maintain, of course, as during expansion, except that work is done upon the steam, instead of by same.

"An amount of heat, therefore, is added to the feed during compression equivalent to the work represented by the area AFJK. This completes the phenomena as far as the influence of the work on the heat changes of the feed are concerned.

"In estimating the amount of condensation in any cylinder due to the work, we would, therefore, proceed as follows:

"Take the total absolute indicated horsepower, BCDGK, and deduct from same the horsepower of admission, BCHK, and then add the horsepower of compression, AFJK. Next, reduce this to its equivalent B. T. U. per hour and deduct from this the B. T. U. given up by the feed between admission and exhaust pressure. Divide this result by the latent heat of steam at exhaust pressure to get the total pounds of condensation per hour, and then by the total pounds of feed per hour, to get the condensation per pound of total feed. Then multiply by 100, to reduce to a percentage basis.

"Neglecting compressions, which exert almost a negligible influence, this may be reduced to a formula as follows:

$$C = \frac{H.P. - \frac{(Q \times 144 \times P)}{33000 \times 60} \times \frac{33000 \times 60}{778} - W(H_1 - H_2)}{W \times H_3} \times 100$$

Where C = percentage of condensation due to work in the cylinder.
H.P. = the absolute indicated horsepower, as explained above.
Q = the cubic feet of dry steam indicated per hour between admission and cut-off (not the entire cylinder feed).
144 = square inches per square foot.
P = absolute initial pressure, as shown in Fig. 1.
33000 = foot-pounds per minute per horsepower.
60 = minutes per hour.
778 = foot-pounds per B.T.U.
W = total weight of cylinder feed per hour.
H_1 = total heat of steam at initial pressure.
H_2 = total heat of steam at exhaust pressure.
H_3 = latent heat of steam at exhaust pressure.

This formula reduces to

$$C = \frac{2545\ H.P. - 0.185\ Q \times P - W(H_1 - H_2)}{W \times H_3} \times 100$$

"It will be seen from the above that there is quite a bit of the work done in the cylinder which does not cause condensation. Also, that the more wasteful the engine the dryer will be the exhaust, other things being equal. Also, that the latter the cut off, the greater the work of admission and the less the condensation due to work. Also, that where cut-off occurs at or near the end of the stroke, as frequently occurs with a pump, little or no condensation may be expected.

"This may help to explain why we sometimes get more exhaust steam for heating purposes from an engine than would otherwise be expected."

LEGAL DECISIONS

Court of Appeals on Multivane Fan Case.

The patent suit brought against the B. F. Sturtevant Company of Boston by the Sirocco Engineering Company, which has been in the courts for the past six years, has just been decided by the United States Circuit Court of Appeals for the Second Circuit, in favor of the Sturtevant Company.

It was claimed that the Sturtevant multivane fan infringed the Sirocco Company's patents, and in the lower court this claim was sustained. The Court of Appeals, however, reversed the former decision and held that there was no infringement. The Court of Appeals further decided that the Sirocco patents in suit were void in view of the development of the fan building art prior to the alleged inventions upon which these patents were based.

As there are probably more multivane fans in use than any other make, the monetary consideration at stake was large.

Heating Plant for Schoolhouse—Enforcement of Contract with School District.

Action was brought to recover the contract price of a heating and ventilating system which the plaintiff had installed in the defendant's schoolhouse during the fall of 1911. The action was in assumpsit. The original contract had been destroyed by fire and the defendant denied the correctness of the copy produced by the plaintiff. The plaintiff contended that the plant was installed under an absolute contract of sale. The defendant did not dispute the price, but alleged that it was installed under a contract allowing it to try the plant for a specified time and to pay for it if it proved to be as represented, and the plant was rejected after such trial, because it was not as represented. The trial court directed a verdict for the defendant, on

the ground that an action in assumpsit would not lie, and the plaintiff's only remedy was by mandamus, the claim being liquidated. It was held that the demand was not a liquidated liability, nor was it made such by the admission of counsel for the school district that the liability was either for the amount named or nothing. The plaintiff's remedy, therefore, was assumpsit, and not mandamus. The term "liquidated," when used in reference to claims against municipal corporations enforceable only by mandamus, signifies claims on which the amount due is either fixed by law or has been ascertained and agreed upon between the parties. The primary purpose of the writ of mandamus is to enforce duties created by law, and it is not designed as a remedy for the collection of debts. It was therefore held that it will not lie to enforce the liability of a school district on a contract for the purchase of a heating plant.

The defendant's moderator testified that the furnace was installed in a satisfactory manner, and no question was raised as to the material used. Evidence for the plaintiff tended to show performance, on its part, of the contract relied upon, and that, when properly operated, the system would produce the results guaranteed; namely, that it would heat the schoolroom to 70° F. during the coldest weather and furnish thorough ventilation during school hours. The plant was used during November and December of 1911, and for some time after the holidays. The teacher then in charge testified that she had difficulty at first in keeping the children warm, but, after being instructed by a representative of the plaintiff, she had success with it, and heated the room properly, being able on a cold morning to reach a temperature of 100°; that the ventilation, in her opinion, was all right, and she used the system as they would let her. Other evidence was introduced tending to show its successful operation. The judgment for the defendant was reversed and a new trial granted.—Waterman-Waterbury Co. vs. School Dist. No. 4, Michigan Supreme Court, 150 N. W., 104.

Use of Sidewalk Gratings in Subway Ventilation.

In connection with the agitation for some means of ventilating the new subways in New York that will obviate the use of sidewalk gratings, a plan has been proposed by George Hallet Clark, engineer, which includes air exhaust ducts directly under the trolley car tracks leading to such open spaces as the city's public squares. According to the present plans of ventilating the subway, the air will be driven out through sidewalk gratings, partly by the piston action of the trains and partly by fans installed for that purpose.

This plan has brought forth much criticism on the ground that the outrushing air would be particularly unsanitary and objectionable to passersby, especially as some of the gratings are to be located in front of the more important stores and hotels on Broadway.

At a recent meeting of the Broadway Association, a campaign was inaugurated against the use of sidewalk gratings as ventilators, the speakers including Chairman William R. Willcox, Chief Magistrate McAdoo and Reginald Pelham Bolton. The association empowered its president, Jefferson DeM. Thompson, to appoint a committee of five to call upon the engineers of the Public Service Commission and express the association's opposition to the gratings. Mr. Bolton declared that the air in the subway can be washed without cutting any openings in the sidewalks and the subway made as desirable a place to travel in as the open country.

New York Chapter Takes Up "Measurement of Air Flow."

Arthur K. Ohmes, of the engineering firm of Nygren, Tenney & Ohmes, New York, was the principal speaker at the February meeting of the New York Chapter, his subject being "Measurement of Air Flow." Mr. Ohmes took up the development of methods of air measurement from their inception, and during the course of his address exhibited various devices for measuring the velocity and amount of air flow, including a carefully made German device that registers an air pressure as low as 1/5000 of an inch of water.

Mr. Ohmes opened his address by stating that instruments for measuring the flow of air can be divided into seven classes, as follows: (1) Direct reading velocity meters; (2) anemometers; (3) pitot tubes and impact discs; (4) Venturi meters and throttling nozzles; (5) volume meters by adding heat to the air to be measured; (6) long distance and centralized air measurements; (7) gauges and micro-manometers.

Mr. Ohmes reviewed the rapid development during the last fifteen years of accurate measuring instruments. Fifteen years ago, he said, we were satisfied to be able to read a column of water accurately

to within 1/10 of an inch. Five years ago 1/100 of an inch was considered an accomplishment, whereas to-day we may readily measure to within 1/1000 of an inch. Also, regarding air currents, ten years ago we could measure them accurately down to 1 ft. per second, while to-day we can obtain accurate measurements when the velocity is one-tenth of 1 ft. per second. Mr. Ohmes predicted that the future would see even greater refinements in this direction.

The speaker then described types of direct reading velocity meters, although he emphasized the fact that such types are not useful for accurate work. Among the devices in this class was a flue velocity meter built into the flue, but arranged for occasional removal for cleaning. He also showed a register velocity indicator of Swiss design, and a portable direct-reading velocity indicator, developed in the office of Alfred R. Wolff, with which one can readily get an idea of the air distribution in a very large plant.

Mr. Ohmes then discussed anemometers and stated that for the ordinary work required by the heating engineer the common flywheel anemometer covers practically all purposes, except at low air velocities, such as 2 ft. per second. He exhibited an anemometer especially designed to eliminate the element of friction losses. This instrument is operated by clockwork at a certain velocity, so that any additional velocity will indicate the velocity of the air current.

Pitot tubes and impact discs were next taken up. The speaker exhibited types of American and German Pitot tubes and called attention to the fact that with the American instrument it was essential to have the air strike the nozzle of the tube full on in order to get accurate readings. With the German tube the nozzle is slightly rounded so that it is not so easily affected by air striking it at an angle. He expressed his opinion that the American instrument was preferable for measuring the static pressure and the German instrument superior for measuring velocity.

Venturi meters and throttling nozzles, according to the speaker, have not been sufficiently appreciated by the ventilating engineer. In actual practice, he said, they are about the simplest means we have for getting approximately accurate results, and they are almost indispensable on feed water and water supply mains. He urged the development of something similar for the more important ventilating systems. He expressed the hope that such meters, with automatic registering devices, will come into more general use for keeping an easy and automatic control over the quality and amount of air handled and the attention the ventilating apparatus receives in general.

Mr. Ohmes then took up volume meters which operate by adding heat to the air to be measured and described the Thomas meter as typical of this class.

Speaking of long distance and centralized air measurement, Mr. Ohmes gave an interesting description of what was being done along this line in the Continent and showed photographs of such apparatus which resembled, in some respects, a modern switchboard. He said there was a great opportunity for the development of heating and ventilating systems in this respect and said the wider use of centralized measurement and control would assist materially in improving the operation of such plants.

Mr. Ohmes concluded his address by describing various types of gauges and micromanometers. As showing the importance of having accurate and delicate measuring instruments, he showed that an air current moving at a velocity of 10 ft. per second will only exert a pressure of

$$P = \frac{v^2 y}{2g \times 83} = \frac{10 \times 10 \times 1.2}{2 \times 32.16 \times 83} = 0.0295$$ in. of water, in which y is the density per cubic foot in ounces.

On the other hand an air current of 11 ft. velocity per second (an increase of 10%) will exert, under the same conditions, $\frac{11 \times 11 \times 1.2}{2 \times 32.16 \times 83} = 0.272$ in of water. The difference is only 0.0047 in. of water, less than 1/200 of an inch.

He then exhibited a micro-manometer of German design, which is capable of measuring a water column to 1/5000 of an inch.

Before opening the discussion, President Timmis called on Mr. Keuffel, of Keuffel & Esser, manufacturers of instruments of precision, who told of the manufacture of air-measuring instruments and their uses.

Mr. Perry West exhibited a number of charts showing the results of readings taken in public school buildings. These varied considerably and showed the difficulty of obtaining accurate results. The tests were made on both sides of the heating coils of a hot blast system.

Willis H. Carrier spoke of the centrifugal action of the air in ducts as affecting the readings and Mr. Ohmes in reply stated that care is usually taken in making tests to insert guides in the ducts to straighten out the air currents. William J. Baldwin also participated in the discussion and asked if any tests had been made of Pitot tubes

having outlets of different shapes or sizes from the interior of the tube. Mr. Carrier stated that he had made such tests but not at different angles. At right angles, he said, there was no appreciable difference. As bearing further on the subject, Mr. Ohmes mentioned a bulletin (Bulletin 35) issued by the American Blower Company, Detroit, Mich., on "The Pitot Tube and Fan Testing" as containing valuable information for the engineer on the general subject of air measurement.

President Timmis stated that he had appointed a committee, consisting of Frank T. Chapman, Arthur K. Ohmes and D. D. Kimball, to confer with Superintendent of Buildings Miller in connection with a revision of the building code of New York.

The report of the entertainment committee which had charge of the entertainment during the society's annual meeting showed a balance on hand of $65. On motion of F. K. Davis, hereafter the entertainment committee will be appointed at the opening of the chapter's new year in April and will take care of the following year's annual dinner, as well as of any chapter affairs held during the year.

In the absence of Chairman J. I. Lyle, of the nominating committee, its report was presented by Frank K. Chew. The other members of the nominating committee are Perry West, George G. Schmidt and W. H. McKiever. The committee has named the following ticket: For president, W. H. Driscoll, New York, and George H. Knight, Newark, N. J.; for vice-president, Arthur Ritter, New York, and P. H. Seward, New York; for treasurer, William J. Olvany, New York, and Charles E. Scott, New York; for secretary, R. B. Hunt, New York, and F. K. Davis, New York; for members of the board of governors: Walter S. Timmis, Perry West, Charles A. Fuller, F. K. Davis, Wallace F. Goodnow and George D. Farnham, all of New York.

Illinois Chapter on "Trouble Jobs."

The February meeting of the Illinois Chapter was devoted to "Trouble Jobs and the Particular Methods Employed in the Correction of the Trouble." The meeting was held at the Great Northern Hotel in Chicago. J. P. Dugger opened the discussion, giving numerous instances of mistakes in boiler installations and the methods used to correct them. Others who told of their experiences in connection with trouble jobs were President Charles F. Newport, H. M. Hart, August Kehm, R. B. Hayward.

The meeting followed a chapter dinner at the Great Northern, and was opened with President Newport in the chair. The committee on air washer tests submitted its financial report, and it was voted to appropriate $100 additional for the purchase of apparatus to continue the tests. Dr. E. Vernon Hill gave an interesting report of the progress made by the committee on air washing and in response to his call for additional assistance President Newport and Secretary Bronaugh offered their services.

H. M. Hart stated that the official report of the Illinois Ventilation Commission was in the hands of the printers and would shortly be issued. He also gave the chapter a report of the society's annual meeting, held in New York in January.

Massachusetts Chapter.

President D. D. Kimball of the American Society of Heating and Ventilating Engineers was the principal speaker at the February meeting of the Massachusetts Chapter, February 9, which followed a chapter dinner at the Revere House. Mr. Kimball's talk was on the work of the New York State Commission of Ventilation and the tests conducted by that body during the past year.

The subject for the chapter's March meeting will be "Early Experiences Covering the Installation of Heating and Ventilating Plants," in which Laurence Franklin will present a paper giving a résumé of the practice of his father, the late Albert B. Franklin, who was one of the pioneers in the heating business in this country.

NATIONAL DISTRICT HEATING ASSOCIATION

Plans for Annual Convention.

Plans for the annual convention of the National District Heating Association, which will be held in Chicago, Ill., June 1-3, 1915, with headquarters at the Sherman Hotel, include papers by C. F. Oehlman, of Denver, Colo., on "Commercial End of the Heating Business;" by W. G. Carlton, of New York, on "Typical Hot Water Heating Plant;" by C. C. Wilcox, of Jackson, Mich., on "A Pressure Survey Study;" and a paper by G. W. Martin, of New York, on "Exhaust Steam vs. Live Steam for Heating."

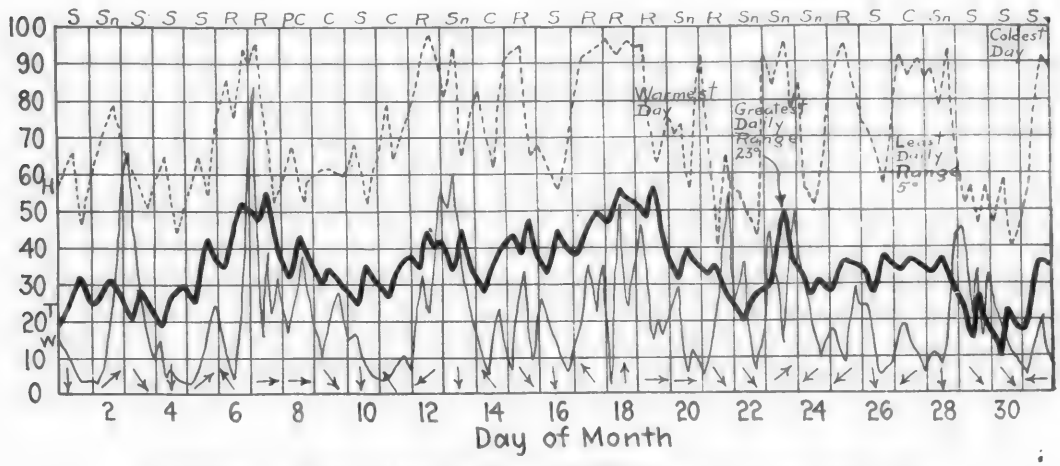
These papers are in addition to the committee reports on rates, underground construction, education, public policy, meters, station operation and station records.

It is stated there will be also three addresses by men of national reputation.

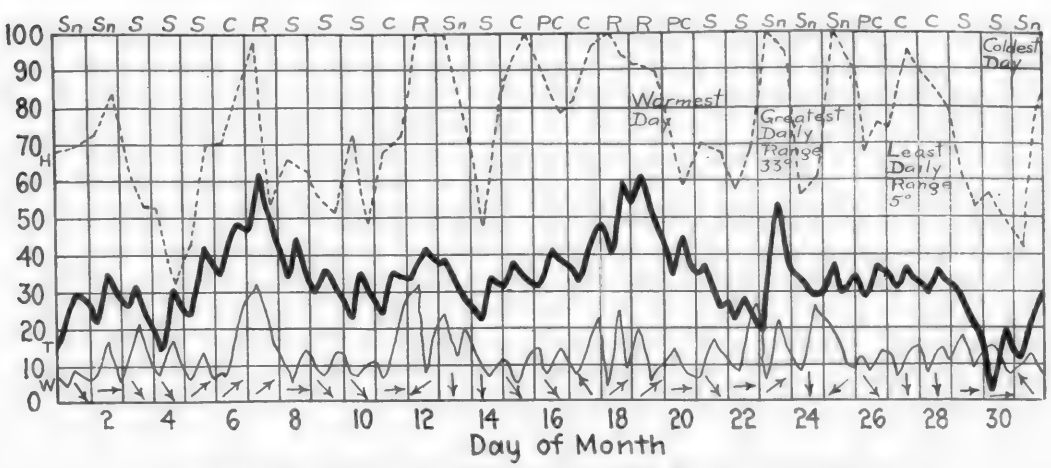
THE WEATHER FOR JANUARY, 1915.

	New York	Boston	Pittsburg	Chicago	St. Louis
Highest temperature, degrees F.	57	61	55	47	59
Date of highest temperature	19	19	17	16	16
Lowest temperature, degrees F.	10	3	4	—8	—4
Date of lowest temperature	30	30	29	28	28
Greatest daily range, degrees F.	23	33	26	23	27
Date of greatest daily range	23	23	23	24	16
Least daily range, degrees F.	5	5	5	4	5
Date of least daily range	27	27	13	12	4
Mean temperature for month, degrees F.	34.1	33	31	24.1	29.6
Normal mean temperature for month, deg. F.	30.2	27	30.7	23.7	31
Total rainfall, inches	5.61	6.33	4.66	1.99	2.83
Total snowfall, inches	4	7	14.6	6.5	11.6
Normal precipitation, this month, inches	3.79	3.82	2.87	2	2.27
Total wind movement, miles	13,088	7,951	8,156	9,015	10,046
Average hourly wind velocity, miles	17.5	10.7	11	12.1	13.5
Prevailing direction of wind	N.W.	N.W.	N.W.	N.W.	S.
Number of clear days	10	12	5	7	9
Number of partly cloudy days	5	3	6	7	7
Number of cloudy days	16	16	20	17	15
Number of days on which rain fell	17	11	18	10	12
Number of days on which snow fell	8	7	10	8	3
Snow on ground at end of month, inches	—	2.3	3	3.8	T.

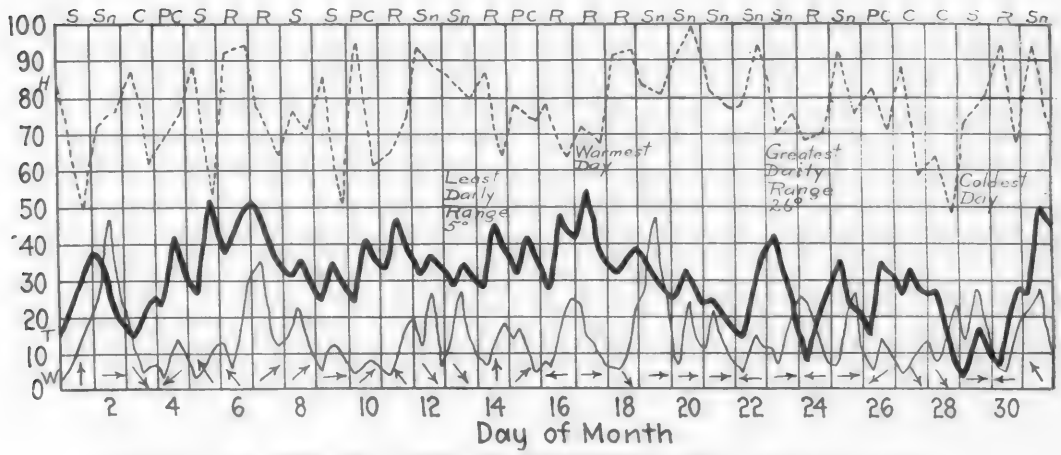
ERRATA—Lowest temperature in December, 1914, was for Boston, —2° F.; Pittsburgh, —2° F.; and Chicago,—4° F.



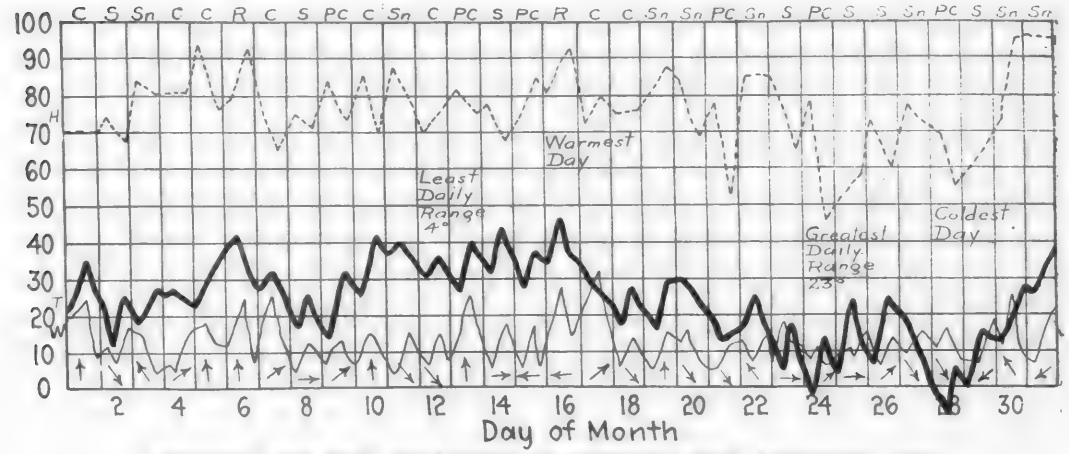
RECORD OF THE WEATHER IN NEW YORK FOR JANUARY, 1915.



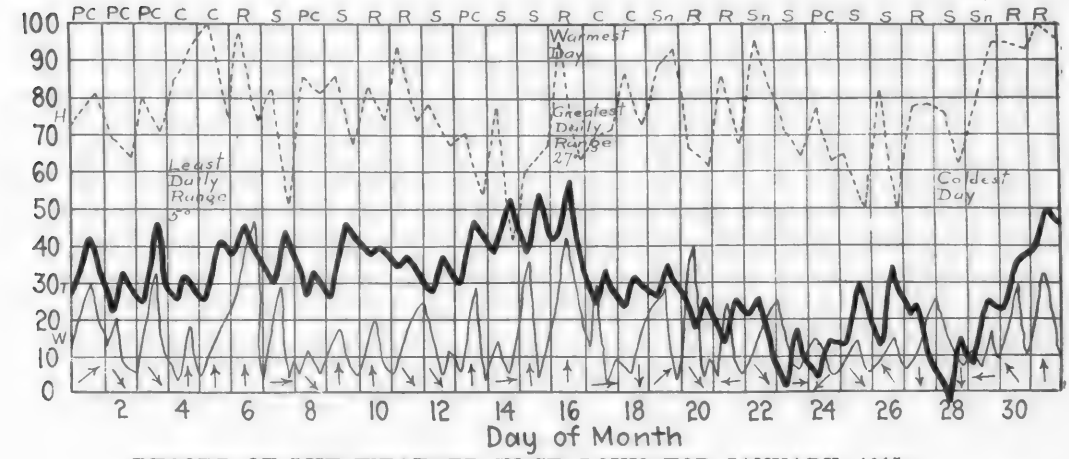
RECORD OF THE WEATHER IN BOSTON FOR JANUARY, 1915.



RECORD OF THE WEATHER IN PITTSBURGH FOR JANUARY, 1915.



RECORD OF THE WEATHER IN CHICAGO FOR JANUARY, 1915.



RECORD OF THE WEATHER IN ST. LOUIS FOR JANUARY, 1915.

Plotted from records especially compiled for THE HEATING AND VENTILATING MAGAZINE, by the United States Weather Bureau.
Heavy lines indicate temperature in degrees F.
Light lines indicate wind in miles per hour.
Broken lines indicate relative humidity in percentage from readings taken at 8 A. M. and 8 P. M.
S—clear, PC—partly cloudy, C—cloudy, R—rain, Sn—snow.
Arrows fly with prevailing direction of wind.

NATIONAL ASSOCIATION OF MASTER STEAM AND HOT WATER FITTERS

Date Fixed for Annual Convention.

Announcement is made that the twenty-seventh annual convention of the National Association of Master Steam and Hot Water Fitters will be held in Milwaukee, Wis., June 21-25, 1915.

Wisconsin State Association.

At the fifth annual convention of the Wisconsin State Association of Master Steam and Hot Water Fitters, held in Milwaukee January 18, the following officers were elected: President, Edmund Grassler, Milwaukee; vice-president, James Smollen, Racine; secretary-treasurer, Fred Kaufmann, Milwaukee; sergeant-at-arms, Otto Biefeld, Watertown. Board of directors: F. H. Meadows, Milwaukee; E. H. Sonnemann, Sheboygan; Frank Kraft, Kenosha; Hugo Francke, Milwaukee, and George F. Reeke, Green Bay. At a dinner following the convention, held in the Elks' Club, in Milwaukee, the speakers included George F. Reeke, Attorneys William Zimmers and Leo F. Nohl, both of Milwaukee; Herman Luedke and F. E. Green.

American Society of Mechanical Engineers.

A proposed system of classifying and digesting the society's records to render instantly available all information on each particular detail of every subject treated was outlined by Edwin J. Prindle, patent lawyer, at a meeting of the American Society of Mechanical Engineers, held in the Engineering Societies Building, New York, February 9. Mr. Prindle's paper covered a plan for classifying, indexing and digesting such records so as to make it possible to turn instantly to information upon a specific subject, without the necessity for an extended research through the various papers and discussions.

New Draft Completed of Mechanical Engineers' New Boiler Code.

Announcement is made that the council of the American Society of Mechanical Engineers has accepted the report of the boiler code committee and that the code will be submitted to the society for its final approval at the spring meeting in Buffalo, N. Y., in June. The boiler code as drawn up by the committee represents work covering a period of three and one-half years, during which time the committee has had innumerable meetings and has drawn up several complete preliminary drafts. The final (fifth) revision was commenced December 15, 1914, and involved day and night sessions, at which were present an advisory committee of eighteen members appointed to co-operate with the original committee. It is probable that the enlarged committee will be made a standing committee by the society, to revise the code as found necessary.

Already several of the State legislatures are planning to make the society's recommendations the basis for legislation on the installation and operation of boilers. In the boiler law enacted in Wisconsin, which went into effect January 1, it is provided that the sections regarding new boilers shall be those adopted by the mechanical engineers' society. It is also reported that the Indiana legislature is planning to enact the code as a State law.

National Warm Air Heating and Ventilating Association.

An attendance of 59 warm air furnace men was registered at the special meeting of the National Warm Air Heating and Ventilating Association, which was held in Cleveland, O., February 17. President John D. Green presided and urged the adoption of an accurate, standard method for testing warm air heaters, so that all makers can place heating values on their own heaters, without having to go to the necessity of having to submit them to outside tests. He urged a wider co-operation on the part of the manufacturers to attain this object.

A number of interesting reports were presented bearing upon manufacturers' cost formula, a formula for warm air installations, submitted by D. Rait Richardson; dealers' costs; selling, advertising and architects; and legislation and building codes.

A recommendation that met with approval was the establishment of an official publication by the association to be sent to furnace men and, occasionally, to architects. This matter will be taken up for further disussion at an association meeting to be held next June.

Institution (British) of Heating and Ventilating Engineers.

Reports of the annual meeting of the British Institution of Heating and Ventilating Engineers, held in London, February 9, show that, although held under the stress of war conditions, the meeting was well attended and was up to the standard in interest. The chair was occupied by President H. H. Grundy. The papers presented included one on "Science in the Development of Gas Heating," by W. R. Trigg, and one on "Some Recent Theories of Ventilation Considered in Relation to Their Present-Day Practice," by E. Herring.

CORRESPONDENCE

Operating Heating Systems Under a Partial Vacuum.

EDITOR HEATING AND VENTILATING MAGAZINE:

The December issue of THE HEATING AND VENTILATING MAGAZINE contained a short article entitled, "Operating Heating Systems Under a Partial Vacuum," in which there was an error in the method of solution of a given problem. The problem was as follows:

A certain room requires 100 sq. ft. of pipe coil with a steam temperature of 220° F. to maintain the temperature of the room of 70° F., with the outside temperature at zero. How much vacuum should be carried on the system to maintain the room temperature at 70° F. when the outside temperature is 20° F.?

The pipe coil was assumed to transmit 300 B.T.U. per square foot per hour under the standard conditions of 150° difference in temperature between the steam and the room, which gives a rate of transmission of 2 B.T.U. per degree difference per square foot per hour. This is the factor usually adopted for pipe coils. In the solution of the problem, however, this factor was assumed to remain constant under all differences of temperature between the steam and the room, which is not true.

The first part of the solution is correct up to the point where the necessary transmission per square foot is determined for an outside temperature of 20° F. This was found to be 214 B.T.U. per square foot. When the pipe coil is transmitting 214 B.T.U. per square foot, the rate of transmission per degree difference is not 2 B.T.U., but something less than that, and the true rate should be determined before a proper solution of the problem can be arrived at.

The writer has found from tests and information given by various authorities that the transmission factor per degree difference for radiators and coils increases or decreases about 2% for each 10° variation above or below the standard of 150° difference, or 0.2% per degree. To illustrate the application of this, assume, as above, a pipe coil in which the steam temperature is 195° F., and the room temperature is 70° F. The difference in temperature in this case is 125°, or 25° below the standard difference of 150° for which the factor, 2, applies. The decrease in this factor, assuming as above 0.2% per degree, would be $0.2 \times 25 = 5\%$. The true value of the factor would, therefore, be $2 - (2 \times 0.05) = 1.9$. The total transmission per square foot would be $1.9 \times 125 = 237.5$ B.T.U.

Applying this to the problem under discussion, let T represent the required temperature in the coil. Then $T - 70 =$ difference in temperature between the steam and the room. To find the number of degrees below the standard difference this must be subtracted from 150 and we have $150 - (T - 70) = 220 - T$. Multiplying this by 0.2% or 0.002, we have the percentage of decrease in the factor, which is $0.002\ (220 - T) = 0.44 - 0.002\ T$. To find the true value of the factor we must multiply this by the factor, 2, and subtract, which gives us $2 - 2\ (0.44 - 0.002\ T)$.

Reducing, this gives $1.12 + 0.004\ T$, which is the true value of the factor under the assumed conditions. This expression, multiplied by the difference in temperature, $(T - 70)$ gives the total transmission per square foot which, we have already found, must equal 214. We may, therefore, establish the expression $(1.12 + 0.004\ T)\ (T - 70) = 214$.

Combining the two expressions in the parentheses gives $0.004\ T^2 + 84\ T - 78.4 = 214$, or $0.004\ T^2 + 84\ T = 292.4$.

Dividing through by 0.004, we get $T^2 + 210\ T = 73{,}100$. Completing the square of the first number and extracting the square root of both sides gives $T + 105 = 290.1$. $T = 185.1$.

The temperature of the steam should, therefore, be 185.1° F., which corresponds to, approximately, 14 in. of vacuum, instead of 16.5 in., as given in the solution.

CHAS. A. FULLER.

New York, February, 1915.

Current Heating and Ventilating Literature.

Under this heading is published each month an index of the important articles on the subject of heating and ventilation that have appeared in the columns of our contemporaries. Copies of any of the journals containing the article mentioned may be obtained from THE HEATING AND VENTILATING MAGAZINE *on receipt of the stated price.*

FANS—

Heaters for Fan Work. C. L. Hubbard. Shows how to compute the size of heaters, to measure their efficiency, and to design pipe connections and determine the size of cast-iron heaters. 1800 w. Engng Mag—Jan., 1915. 40c.

The Testing of Fans, With Special Reference to the Measurements of Pressure. Thomas Bryson. Also discussion. Plate. 3500 w. Trans Inst of Min Engrs—Vol. XLVIII, Part 1. 60c.

PIPING—

Steam Piping Chart. H. D. Austin. Gives chart and explanation of its use. 1500 w. W. Engng—Dec., 1914. 40c.

VENTURI FORMULA—

Note on the Modified Venturi Formula for Flow of Gases or Vapors. G. B. Upton. Explanation of a new expression and its use. 1200 w. Sib jour of Engng—Dec., 1914, 40c.

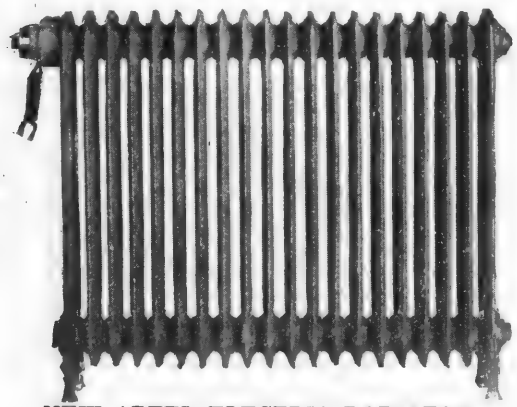
NEW DEVICES

Apfel Electric Heaters.

Two electric heating devices, one an electric hot water radiator, and the other an electric water heater for domestic purposes, have recently been patented by P. F. Apfel, of Apfel & Jansen, Seattle, Wash., contracting engineers for electric and steam and hot water heating installations. They are shown in the accompanying illustrations. The chief merit claimed for the radiator, as compared with the various types of air heaters, is that it does not become overheated so that there is no possibility of burning. Also there is no burning out of the coils because oxygen is eliminated and never comes in contact with the coils. In addition, the coils are kept comparatively cool by the circulating medium which disseminates the heat through the radiator. There is no vitiation of the atmosphere as with a coil heated red hot.

In operation this method of heating, of course, eliminates ashes, coal soot, dust, dirt, gases and unhealthy odors, with the attendant labor, to say nothing of having the basement as clean and accessible and free from dirt as the living rooms.

The Apfel system, it is claimed, can be installed at a cost that will compare favorably with that of the ordinary steam or hot water heating system. As to the cost of operation, it can be used on either direct or alternating



NEW APFEL ELECTRIC RADIATOR.

current and, in Seattle, this is supplied for ½ cent to ¾ cent per kilowatt, which, it is believed, is the lowest rate ever quoted for electric current consumption in this country.

Even at this rate the cost is considerably above that of other heating systems, but there is on the other hand the saving of time, trouble and inconvenience, while in mild winter weather it can be utilized only as required. By "pressing a button," the degree of heat given off by each radiator may be readily controlled.

A number of installations has already been made in Seattle, including the general offices of the Pacific Hardware and Steel Company,

ELECTRIC WATER HEATER.

the Great Western Stove Company and the residence of Dr. Judson W. Mather at Kirkland, Wash.

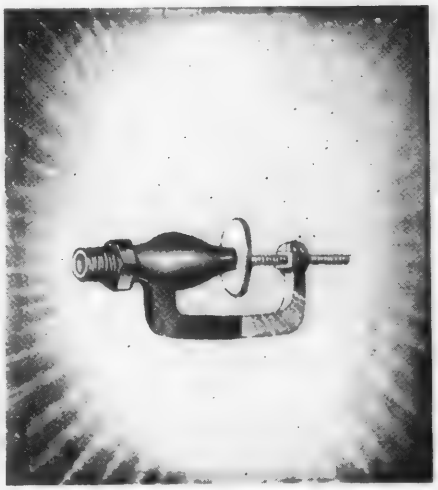
The Apfel electric water heater is of simple design and is capable of supplying tanks from 30 gal. to 30,000 gal. capacity. It is 3 in. x 30 in. in size and can be located in the basement where, it is stated, it will require no attention, no matches or even switches. The cost of operation has been found to be comparatively low, the electric companies in Seattle making special flat rates per month based upon continuous operation. The electric water heater is listed at $25.

The Ideal Air Washer.

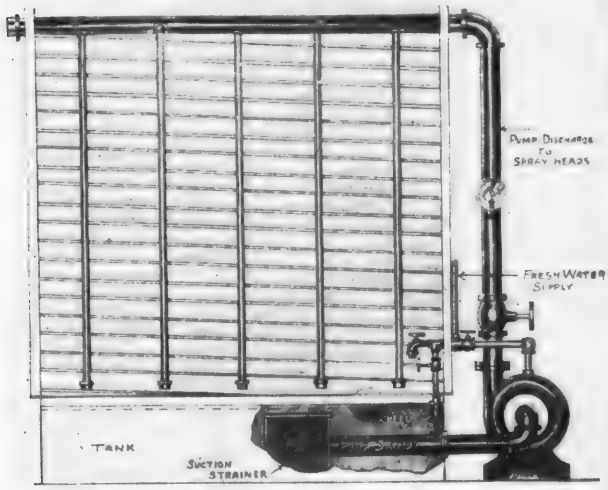
A new type of air washer which, it is stated, is the result of over ten years' practical experience in the manufacture and erection of

different types of air conditioning apparatus, has been invented by George C. Derby, 1108 Irving St., San Francisco, Cal., and is being marketed by him. It was first placed in the market by the California Air Purifying Company, the change being made January 1, 1915.

The accompanying views show the general construction of the Ideal air washer. It will be noted that the spray heads form two complete sheets of water through which all the air must pass when in operation. The eliminator plates are set on an angle of 30°, instead of the more usual practice of 45°. It is claimed that with this arrangement there is less resistance to the air.



IDEAL SPRAY HEAD IN OPERATION.

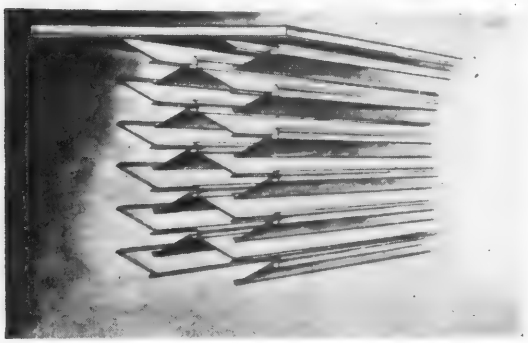


FRONT ELEVATION OF IDEAL AIR WASHER.

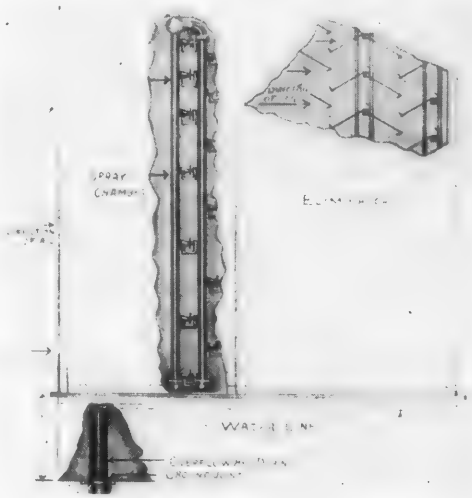
Special attention is called to the construction of the eliminator plates, the second and fourth rows of which have a gutter at their upper edges which drops down below the plane of the plate. This gutter has a projecting lip on its upper side which catches all free moisture that otherwise would be forced over the top of the plate by the current of air passing through the washer to the fan. The gutters are inclined to one end and discharge into vertical return pipes that return all water to the tank.

The Ideal spray head is made of solid brass and is said to be non-cloggable. The water has an unobstructed passage of 3-16 in. through all its parts. There are approximately two spray heads to each 1,000 cu. ft. of air handled by the washer and, as stated, they are staggered in such a way that the air must pass through the two sheets of the spray before reaching the eliminator.

An improved strainer box, with an extra large area, incloses the foot valve. The brass screens used may be easily removed for cleaning. The water is drained from the tank by lifting out the standing overflow pipe which



ELIMINATOR CONSTRUCTION OF IDEAL AIR WASHER.



END VIEW, IDEAL AIR WASHER.

has a ground joint flush with the bottom of the tank.

The company has made some notable installations of the Ideal air washer, the list including such buildings as Trinity Auditorium, Los Angeles, where the installation is capable of humidifying 100,000 cu. ft. of air per minute; also the State Normal School, Los Angeles, containing 13 Ideal air washers. An interesting catalogue entitled, "Pure Air and How to Obtain It," describes the Ideal air washer in detail.

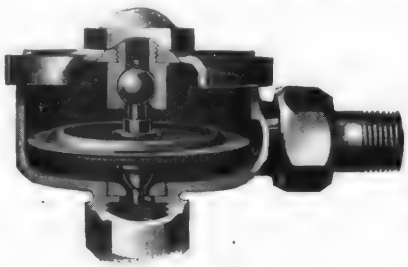
New Publications.

HEATING AND VENTILATING BUILDINGS, sixth edition, by Prof. Rolla C. Carpenter, revised and rewritten, has just been published by John Wiley & Sons, 432 Fourth Avenue, New York. In this edition considerable new matter has been added and the size of the book, as compared with the first edition, has been increased by nearly one-half. Since the first edition, several new chapters have been added relating to fans or blowers for moving air, mechanical systems of heating and ventilation, schoolhouse heating and ventilation, and air conditioning. The sixth edition also describes the latest improvements in the art and gives directions for the construction and installation of all the various systems now in use. A noteworthy feature of this work is the collection of useful tables and data for the use of the heating engineer. This collection is, we believe, one of the most complete to be found and adds very materially to the value of the book. Size 6 x 9 in. Pp. 605, with 290 figs. Cloth, $3.50 net. May be had through the book department of THE HEATING AND VENTILATING MAGAZINE.

Trade Literature.

KATCH-DRIP, a device that fits on a radiator air valve, and which is intended to supply moisture in the form of steam for humidifying rooms, has been placed on the market by the Katch-Drip Sales Co., 419 Madison street, Brooklyn, N. Y. It is arranged to catch all water, while allowing a certain percentage of steam to escape to the room. It is stated that the device will deaden that sizzling sound from the steam when the valve is open. It is listed at 35 cents.

RELIABLE RETURN LINE VACUUM HEATING SYSTEM, including each part of the equipment, is illustrated and described in a new catalogue issued by the manufacturers, the Bishop-Babcock-Becker Co., Cleveland, O. This catalogue, it is stated, supersedes all previous issues. Special attention is called to the company's guarantee which covers the correctness of the mechanical principles and construction of the apparatus, the testing and adjustment of all parts and, finally, an agreement to replace or repair, free of charge, any parts proven defective—ordinary wear and tear, abuse and neglect excepted—upon delivery to the company's factory for inspection. In discussing the adaptability of the system, it is stated that it is equally efficient for new or old two-pipe steam heating plants, in any style or size building. The low cost of installing the Reliable system is emphasized. One section takes up in an interesting manner the equipment and changes required to install a Reliable system in connection with a steam heating plant already in operation, at the same time making it 100% efficient. The illustrations include different types of the Reliable return line electric vacuum pumps, automatic switch and vacuum controller, return line strainer, etc., while several pages are given over to a description of the "Vacu-Trap" and its operation. A double-page illustration shows a typical layout of the Reliable system. Size 5 x 8 in. Pp. 24.

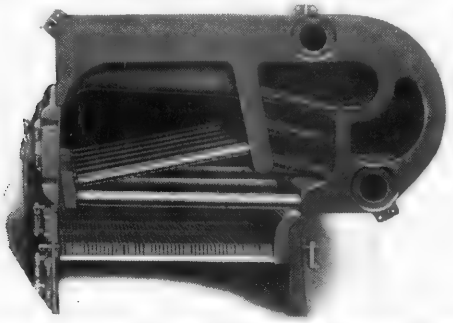


NO. 1 RELIABLE "VACU-TRAP."

WENTZ THERMOSTAT, for use in connection with a gas-heated hot water boiler, is featured in circular matter being sent out by the manufacturers, the Wentz-Yoder Mfg. Co., Engineers' Building, Cleveland, O. The device acts automatically to turn on and off the gas, as necessary. It is claimed that with this arrangement the same results are secured as with a high-priced instantaneous heater. It has no stuffing box through which gas can leak and no valve stem to pack or to stick when packed too tight. It is made with a patented system of multiple levers.

SEABURY WATER TUBE BOILER, for stationary and marine services, is the subject of a carefully-prepared catalogue, profusely illustrated, issued by the makers, the Gas Engine & Power Co. and Charles L. Seabury & Co., Consolidated, Morris Heights, New York. This boiler is designed to meet the requirements of a light-weight boiler, occupying a minimum of floor space per horsepower, besides having the essential qualities of safety. The illustrations include sectional and other views, taken from photographs, together with all the necessary data. Size 6 x 9¼ in. Pp. 48.

BURN THE SMOKE by using Bernard smokeless boilers, is the advice contained in a new catalogue of the Bernhard smokeless down-draft boilers, issued by the mnaufacturers, the Kanawha Mine Car Co., Charleston-Kanawha, W. Va. This boiler is described as the



BERNHARD SMOKELESS DOWN-DRAFT BOILER.

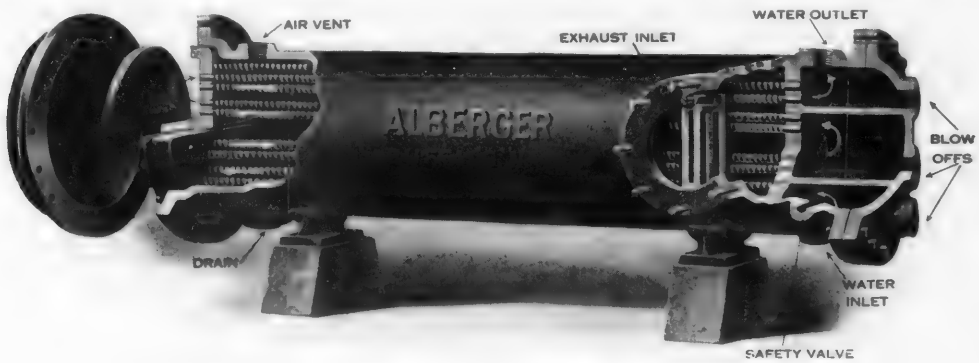
lowest in stature, and the highest in efficiency. It is stated that the poorest grade of soft coal can be successfully burned, without smoke, in this boiler, and that the boiler can be successfully used on any system of heating where a low pressure boiler can be used. It is de-

HEATING WATER WITH STEAM is the title of a recent catalogue issued by the Alberger Heating Co., Buffalo, N. Y., and devoted to the Alberger multi head heaters. The company's product, as noted in the catalogue. includes feed water heaters, domestic service heaters, forced circulation hot water heaters, laundry heaters, oil heaters, condensers, expansion joints, etc. The illustrations show in detail the construction of the multi-head heater which consists primarily of a cast-iron cylinder containing straight copper tubes having helical corrugations, one end of each tube being expanded into a fixed head while the other end is expanded into a floating head. The catalogue includes views of typical installations and there are also diagrams of preferred piping arrangements to Alberger multi-head heaters. Announcement is also made that the company has placed on the market a new expansion joint known as the Ross expansion joint, the primary feature of which is the device for guiding the pipe line, so that it must necessarily be in perfect alignment with that part of the piping which is held rigid. The object of this feature is to prevent the ordinary wear and tear on packing which is often experienced with slip-tube expansion joints. The catalogue includes illustrations of this expansion joint. Size 6 x 9 in. (standard). Pp. 24.

BUFFALO PLANOIDAL FANS, described as a modification and improvement on the older type of steel plate heating and ventilating fans, with a comparatively small number of radial blades, are featured in a new catalogue (Catalogue 200) just issued by the Buffalo Forge Co., Buffalo, N. Y. With the improvements which the company has made, this type of fan, it is stated, will compete, for most conditions, on an equal basis with the multiblade fans. The catalogue contains full construction details of this interesting apparatus which for ordinary heating and ventilating work, has shown no appreciable inferiority to the most efficiently designed multiblade fans.

Another new publication (Catalogue 201) is devoted to Niagara Conoidal fans. In addition to having all the advantages of the multiblade type in respect to higher operating speeds, more compact arrangement, and greater rigidity, the shape and blades and proportion to the housing used in the Niagara Conoidal, makes it possible to convert into static head the velocity head, which is much higher proportionately to the total pressure with multiblade fans than with older types having few blades. This catalogue is also profusely illustrated and contains all the desired information for the use of the engineer in selecting fan apparatus.

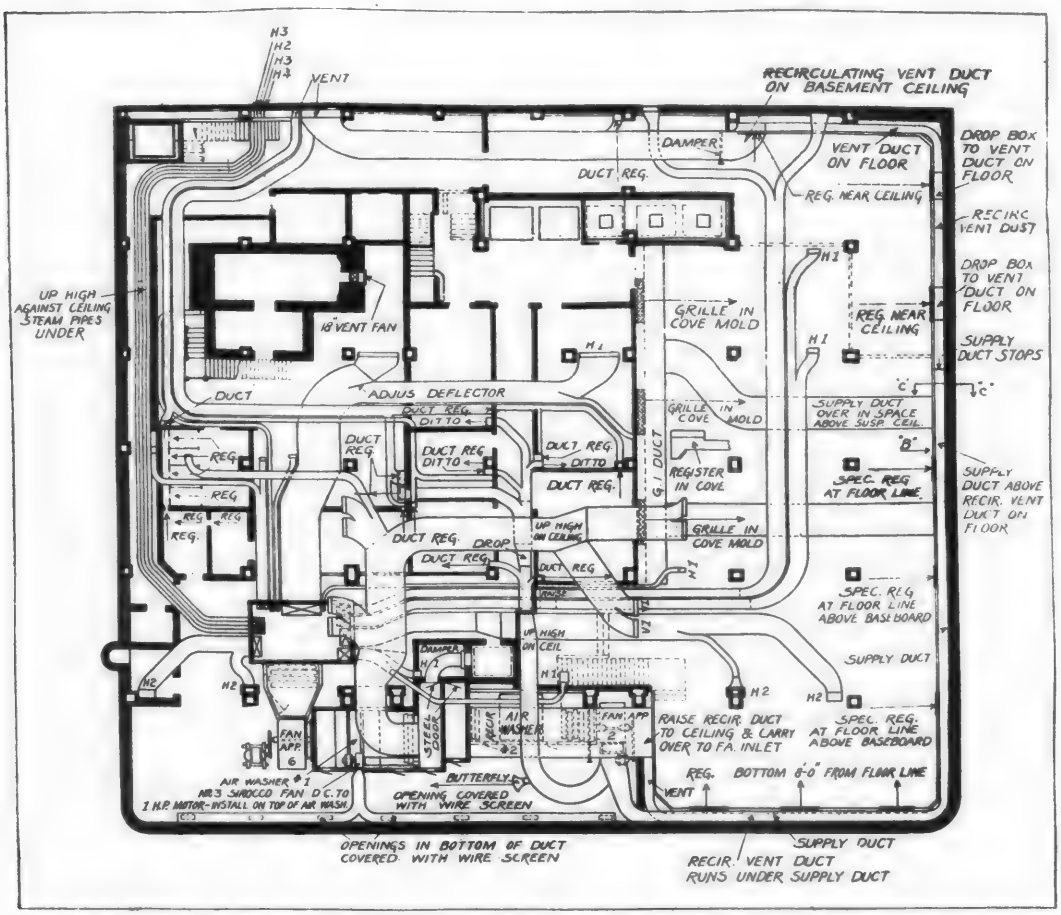
Catalogue 182-E, also issued by the Buffalo Forge Company, is devoted to Buffalo electric fans, for blowing, exhausting, ventilating, cooling and drying. In this catalogue the various



ALBERGER MULTI-HEAD WATER HEATER, HORIZONTAL TYPE.

types of blowers and exhaust fans which are regularly built for direct connection to motors, are collected for convenient reference. The types include everything from large ventilating and drying fans down to the little Baby Conoidals for ventilating moving picture booths, drying cabinets, etc., and electric blowers for single forge fires, which take less than half the horsepower of an ordinary electric lamp. Size of each catalogue, 6 x 9 in. (standard). Catalogue 200, 48 pages; Catalogue 210, 64 pages; Bulletin 182 E, 32 pages.

VENTILATING THE FLETCHER SAVINGS AND TRUST BUILDING, Indianapolis, Ind., is described and illustrated in a special bulletin published by the American Blower Co., Detroit, Mich. The equipment includes Sirocco multiblade fans of large air handling capacity in the basement to supply fresh air, washed and tempered to the bank rooms above and to a restaurant located in the basement. An exhaust fan on the sixteenth floor removes the impure air from the building as a whole, while separate exhaust systems are provided for the restaurant and toilets.



BASEMENT PLAN, FLETCHER SAVINGS AND TRUST COMPANY BUILDING.

Sanitary Industrial Surveys Offered by the New York City Department of Health.

One of the announcements in the Weekly Bulletin of the Department of Health, City of New York, states that the department is prepared to undertake a sanitary survey of any industry, trade or group of manufacturing or mercantile establishments in New York, with a view of appraising existing conditions and in order to show to employers and workers alike what can be accomplished through a system of voluntary hygienic and sanitary control. Through its bureau of public health education, the department states that it will be glad to assist in formulating sanitary industrial standards and measures for the prevention of occupational diseases. In addition to this the bureau stands ready to prepare and furnish health leaflets especially designed for workers in any industry and to supply popular lectures on health and sanitation to such workers, in co-operation with either employers or trade unions. The director of the bureau is Charles F. Bolduan, M. D.

New York Steam Company Under New Management.

Announcement is made that A. E. Duram, formerly of the Central Station Engineering Co., of Chicago, and more recently of the American District Steam Co., of North Tonawanda, N. Y., has been elected president of the New York Steam Company, with headquarters in New York. Mr. Duram succeeds G. C. St. John. C. A. Gillham, also formerly of the Central Station Engineering Co. and of the American District Steam Co., has been elected vice-president of the New York Steam Co., succeeding C. C. Upham.

The change in management is looked upon as the beginning of a new period of development for this company which has recently been characterized as "the largest and most important company in the country and probably in the world for the distribution and sale of steam."

As announced in these columns some months ago, the New York Steam Company has been directed by the New York Public Service Commission of the First District to replace certain portions of its underground steam system with mains of more modern design. This applies to some 58,000 ft. of mains, some of which are close to the extensions of the New York subway where, it was feared, the leakage of heat from the steam pipes would destroy the waterproofing of the subway. The New York Steam Company has just accepted a revision of the order as applying to 30,000 ft. of its mains, although the type of construction has not yet been definitely determined. The work is to be done within three years, at a rate of not less than 10,000 ft. per year.

Important additions to the company's power station at the East River and 59th Street are also being made, including the installation of new boilers. A number of extensions to the company's distribution system in both the uptown and downtown districts are also to be made during the coming summer.

Building Operations for December.

December building operations in 68 American cities, according to The American Contractor, Chicago, were $34,310,484, as compared with $58,661,519 for December, 1913, a decrease of 41%. Taking the records for the entire year of 1914, the falling off was 9%. Among cities that showed gains were St. Paul, Salt Lake City, South Bend, Seattle, Denver and Oklahoma City. New York reported the largest decrease, amounting in Manhattan to 90%. Chicago showed a slight gain.

The figures for January, 1915, are slightly better. The total building operations in 75 cities, were $34,712,718, compared with $46,447,497 for January, 1914, a decrease of 25%. New York reversed its December showing by reporting a gain of 35%. The comparative loss in Chicago was 9%. The total figures for New York City were $12,532,156 as against $9,326,742 a year ago.

Cost of Heating and Ventilating Systems.

In a study of the cost of installation of heating and ventilating plants, made in a number of schools, it was found that the prevailing custom of apportioning a certain percentage of the total cost of the building for the installation of the heating and ventilating plant is of no value, as these percentage ratios vary more than 100%, even with similar classes of installations. For a given size of building, the cost of the heating and ventilating system will be approximately the same whether the building is a monumental stone structure or a plain wooden structure, but the percentage of cost of the system will be very different.

CLASSIFICATION OF SYSTEMS.

As a result of this study, the following scheme of classification has been arrived at:

Class A. Plants providing for fire-tube boilers, double fan systems, air washers and humidifiers, individual or double duct systems and modulating control of direct radiators and mixing dampers.

Class B. Same as Class A, but using automatic stokers and water, tube boilers instead of fire-tube boilers.

Class C. Same as Class A, but eliminating the modulation control of radiators and dampers and using the single trunk ducts.

Class D. Same as Class C, except that it eliminates the use of air washers and humidification systems.

Class E. All other systems.

Manifestly there are many combinations of equipment which render an exact determination of classification difficult, but in general this classification has proven satisfactory.

After a careful study of this method of classification and the figures on costs as thus obtained, it was found that the only satisfactory basis of determining the cost of the installation of the heating and ventilating plant was on the basis of the cubic feet of space in the building. The variation in costs within the different classes of systems is rarely over 10% from the average, the greatest variation occur-

ring in Class A. The resulting costs are as follows:

Class A, cost of plant per cu. ft. 2.7c to 3.3c—average 3.1c.

Class B, cost of plant per cu. ft. 3.3c to 3.8c—average 3.4c.

Class C, cost of plant per cu. ft. 2.2c to 2.5c—average 2.4c.

Class D, cost of plant per cu. ft. 2.2c to 2.3c—average 2¼c.

Class E, cost of plant per cu. ft 1.9c to 2.2c—average 2.1c.

If classes D and E were but abandoned and a proper amount of skill were used in the design, installation and operation of the remaining classes, a sufficient appropriation being provided for the installation and operation of the ventilating plant, it is believed that little basis would be left for complaint as to the success of the artificial ventilating system.

Classes D and E are the result of a too limited appropriation, a demand for too large a building for the funds available, too much ornamentation, or too much equipment, or, in other words, an attempt to build a $100,000 building with a $75,000 appropriation, the greatest sacrifice being made in connection with the heating and ventilating plant. Better were a proper building, well equipped, though smaller.

As a matter of information it is interesting to note that the cost of plumbing equipment for school buildings ranges from three-quarters of a cent to one and one-half cents per cubic foot, the average being one and one-tenths cents. The cost of electrical equipment, exclusive of electric power plants, ranges from one-half to one cent per cubic foot, the average being seven-tenths per cubic foot.

In the case of the heating and ventilating, plumbing and electrical work, the costs seem to be approximately the same in grade schools and high schools.—D. D. Kimball in the School Board Journal.

ADVERTISERS' INDEX

American Blower Co..... 72
American Radiator Co.....Back Cover
Armstrong Mfg. Co..... 63
Bicalky Fan Co..... 12
Bishop-Babcock-Becker Co..... 64
Books on Heating and Ventilation..... 77
Bristol Co., The.....Front Cover
Buffalo Forge Co..... 5

Carrier Air Conditioning Co..... 67
Central Station Steam Co..... 8
Century Ventilating Co..... 66
Connersville Blower Co..... 3

Davis Regulator Co., G. M..... 8
Detroit Lubricator Co..... 66
Dixon Crucible Co., Joseph..... 78
Dunham Co., C. A..... 12

Foster Engineering Co..... 7

Globe Ventilator Co.....Front Cover
Gurney Heater Mfg. Co.....Front Cover

Hackney Ventilating Co..... 3
Harrison Safety Boiler Works, Inside Frant Cover
Hornung, J. C. 81
Hutchison Vapor Heating Corporation 70

Ilg Electric Ventilating Co..... 4
Industrial Instrument Co. 65

Jenkins Bros. 65
Johns-Manville Co., H. W..... 81
Johnson Service Co..... 75

Kelsey Heating Co. ..... —
Kernchen Co., The 10
Knowles Mushroom Ventilator Co., Front Cover

Marsh Co., Jas. P..... 7
Michigan Pipe Co.....Front Cover
Monash Engineering Co..... —
Morthead Mfg. Co. 6
Mouat-Squires Co. 8
Mueller Mfg. Co., H..... 6

Parker Supply Co. 75
Patterson & Co., Frank.Inside Back Cover
Paterson Publishing Co. 79
Powell Co., The Wm..... 79
Pressed Metal Radiator Co..... 9

Ric-Wil Underground Pipe Covering Co. 76
Ross Valve Co.....Front Cover

Sarco Engineering Co. 78
Scaife Sons Co., Wm. B..... 79
Sims Co., The.....Inside Back Cover
Spencer Turbine Cleaner Co..... 80
Standard Thermometer Co. 70
Standard Wood Pipe Co..... 79
Sturtevant Co., B. F.....71-73
Syracuse Faucet & Valve Co..... 82

Taylor Instrument Companies 82

United Vacuum Appliance Co..... 10

Webster & Co., Warren..... 69
Wells & Newton Co..... 68
Westinghouse Electric & Mfg. Co.... 74
Wyckoff & Sons Co., A..... 80

Zellweger & Sons, J..... 69

TRADE AND MISCELLANEOUS NOTES

Coming Events.

March 17-18, 1915.—Meeting of the National Association of Brass Manufacturers, in Detroit, Mich.

May 11-13, 1915.—Annual convention of the National Pipe and Supplies Association in Buffalo, N. Y. Headquarters at the Hotel Lafayette. Secretary, George D. McIlvaine, Oliver Building, Pittsburgh, Pa.

June 1-3, 1915.—Seventh annual convention of the National District Heating Association in Chicago, Ill. Headquarters at the Hotel Sherman.

June 21-24, 1915.—Twenty-seventh annual convention of the National Association of Master Steam and Hot Water Fitters in Milwaukee, Wis.

Third Monday in Each Month.—Meeting of the New York Chapter, American Society of Heating and Ventilating Engineers, Engineering Societies Building, New York (evening).

Second Monday in Each Month.—Meeting of the Illinois Chapter, American Society of Heating and Ventilating Engineers, in Chicago (evening). Secretary, W. L. Bronaugh.

Third Tuesday in Each Month.—Meeting of the Massachusetts Chapter, American Society of Heating and Ventilating Engineers, in Boston (evening). Secretary, Charles Morrison, 31 Union Street, Boston, Mass.

Deaths.

P. S. Hudson, vice-president of Baker, Smith & Co., heating and ventilating engineers and contractors, died at his home in Chicago, January 16. He was 64 years old. Mr. Hudson was an old-time resident of Chicago. He was a thirty-second degree mason. A widow, one son and one daughter survive him.

George W. Oby, member of the heating and plumbing firm of Smith & Oby, Cleveland, O., died at his home in that city February 7, from pneumonia. He was 75 years old. He was for many years asociated with A. C. Eynon, in the heating and plumbing business in Canton, O.

Clinton C. Jenkins, formerly treasurer of the Pierce, Butler & Pierce Mfg. Co., Syracuse, N. Y., died in New York, January 29. He was 55 years old. Mr. Jenkins retired from business several years ago.

James F. McElroy, inventor of the electrical heating apparatus in wide use in trolley cars, died February 10 at Laconia, N. H., at the age of 62. He was the organizer of the Consolidated Car Heating Company of Albany, which was his home city. In 1887 he organized the McElroy Car Heating Company, operating under its own patents, which, two years later, was combined with the Sewell Car Heating Company.

Miscellaneous Notes.

Sacramento, Cal.—Reports from Sacramento state that heat magazines are now being built as a substitute for stoves, and designed to use electricity to store up heat in the hours when the demand for electric power is small and consequently when electricity may be supplied at greatly reduced rates. This is usually between midnight

Genuine Armstrong Stocks and Dies

MALLEABLE HINGED PIPE VISES

PIPE CUTTERS

PIPE MACHINES, HAND OR POWER

The Tools of Constant Service

Manufactured by **Write for Catalog**

THE ARMSTRONG MFG. CO., 321 Knowlton St., BRIDGEPORT, CONN.

Please mention THE HEATING AND VENTILATING MAGAZINE *when you write.*

and 5 A. M. The magazines are made in the form of large steel boxes about the size of a house stove.

Bloomington, Ill.—The building committee of the State Board of Education has decided to locate the new $30,000 heating plant for the University of Illinois on the southeast corner of the campus. Work will commence on the new plant in the spring. The old heating plant will be converted into a manual training shop.

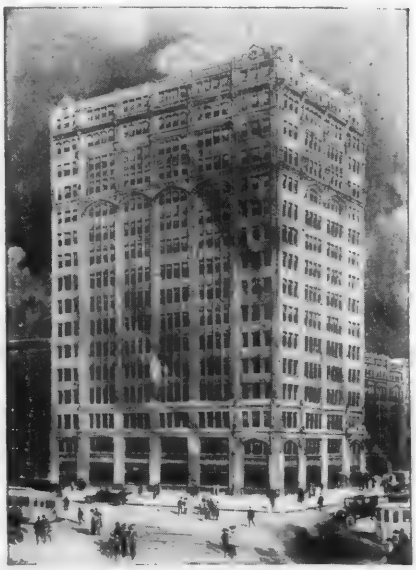
Salt Lake City, Utah.—The Eckersley bill regulating the construction of country school buildings, with particular reference to window lighting, heating and ventilating requirements, has been recommended for the passage by the senate committee on education.

Portland, Ore.—An explosion of oil in the central heating plant at the State House, just outside the basement of the building, was followed by a fire that for a time threatened the Capitol. Fearing that a couple of tanks filled with oil were in danger of exploding and scattering the fire to all parts of the building, the fireman had the presence of mind to run through the smoke and shut off the connecting pipe feeding the fuel oil to the burners of the heating plant. The damage was nominal.

Detroit, Mich.—Two bills have been introduced in the Michigan legislature designed to regulate the ventilation of school and other public buildings. One of the bills has been introduced by Senator Damon, of Mt. Pleasant, which is characterized as "the most sweeping thing of its kind ever offered in a Michigan legislature. The proposed law applies to every public school house, church lodge room, theatre or other public hall in this State where people congregate for worship, mutual benefit, amusement or pleasure." The bill would make the superintendent of public instruction and the secretary of the State board of health absolute arbiters of ventilating systems in the room and buildings enumerated. These two officials would pass upon plans that would have to be followed by owners. Within 30 days after the passage of the act the secretary of the board of health and the superintendent of public instruction would have to advertise for the submission of plans for ventilating systems. They would select from among those offered those they thought suitable, and these would then be the plans applicable to all buildings in the State, in the classes mentioned. Owners of the buildings and those planning new school houses of the class within the scope of the act would have to come to the two State officials and get their plans. The cost would be the actual cost, plus 10%.

You Save Time, Labor and Trouble

and insure most efficient service—not only for a few months, but for all time—when installing



RELIABLE
Vacuum Heating Equipment

no adjustments necessary when installing, or later. All adjustments are permanently adjusted at the factory. The

Air Line—Return Line—Vacu-Vapor

Systems cover all styles of installations—for all kinds and sizes of buildings. With them the desired heat is assured, in zero or mild weather. You should know about the VacUstat, Vacu-Trap, Vacu-Check, RELIABLE Automatic Electric and Hydraulic Vacuum Pumps, and other Reliable Heating Equipment. ALL RELIABLE Equipment is standardized and staple, and sold by representative jobbers.

Two No. 115 RELIABLE Electric Vacuum Pumps, and 530 VacUstats are installed in the new Hallenbeck-Hungerford Building, New York City, illustrated herewith. Wm. E. Austin, Architect; The Wells-Newton Company, Heating and Ventilating Engineers.

Descriptive catalogs and lists of some prominent installations will be mailed free on request.

THE BISHOP-BABCOCK-BECKER CO., General Offices, CLEVELAND, OHIO

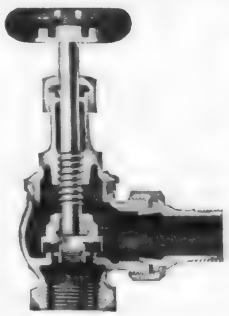
In the case of State institutions, plans would be furnished free of cost. In case any of the officers of a public school should refuse to put in the ventilating system decided upon, the district would lose one-half of its primary fund money from the State. In the case of other buildings, upon complaint of three persons under oath, the secretary of the board of health would order the local health officer to have the system installed, the cost of installation being reported back to the State officers and by them turned over to the officers having the tax levy in that district, who would spread it upon the rolls. The act is designed to take effect November 15, 1915. The other bill relating to the ventilation of public school buildings, was introduced by Senator Plank and was drafted by Superintendent of Public Instruction Keeler and Secretary Burkart, of the State Board of Health. This bill provides that in all cases where school buildings costing more than $300 are planned, the plans must be submitted to the secretary of the State board of health and to the superintendent of public instruction for approval. This means that these officials would be able to dictate as to ventilating, lighting, heating, etc.

Chicago, Ill.—A subcommittee of the city council committee on buildings is considering ordinances permitting and also prohibiting the maintenance of salesrooms in sub-basements. Health Commissioner Young has taken a definite stand against basement salesrooms. On the other hand, representatives of firms which have established "subway stores" at considerable expense, contend that, with proper regulations regarding ventilation, such stores should continue to be permitted. One of the inspection trips taken by members of the committee was through the Mandel Store, which has sub-basement salesrooms.

Streator, Ill.—An electric light and heating ordinance was proposed in Streator which provided for shutoffs in steam pipes, which are in the inside of a building, being placed on the outside in order to protect the firemen in case of a fire. Alderman Fanning stated that such an ordinance might inconvenience many property owners who use city heat. In the case of the system in Streator, the removal of the shutoffs to the outside of buildings would necessitate the removing of the pavement in the municipal streets and the construction of manholes.

Columbus, O.—The new central vacuum steam heating plant for Capital University is now under construction. It will be located south of the Science Hall and Loy Gymnasium. The plant will cost $10,000.

Pittsburgh, Pa.—Charles W. Renner, assistant general foreman in the car shop department of the Pennsylvania Railroad shops in Altoona, has received a patent for a ventilator and cinder deflector, especially designed for steel passenger coaches.



JENKINS BROS. VALVES

contain the Jenkins Renewable Composition Disc which forms a flexible seat, making the valves absolutely tight. The Jenkins Discs give long wear without requiring any attention, but when worn out can be replaced in a few minutes at slight expense. The **valves do not wear out in service**—once installed, they will last a lifetime.

Have your specifications read—

"Jenkins Bros. Valves with Diamond Trade Mark"

JENKINS BROS.

NEW YORK BOSTON PHILADELPHIA CHICAGO MONTREAL LONDON

SPECIFY FOXBORO THERMOMETERS

TRADE MARK

THE LATEST AND BEST BY EVERY TEST Send for Bulletin No. 73

New York 50 Church St. **The Industrial Instrument Co., Foxboro, Mass.** Chicago Monadnock Bld

United Bunch of Sheep, Home Fold, composed of heating and plumbing salesmen, held its annual meeting January 16, at the St. Charles Hotel, Milwaukee. Officers were elected as follows: Grand Ram, A. L. Klug; Vice-Ram, F. W. Baetka; Chief Shearer, R. G. Hohnback; Keeper of the Golden Fleece, F. Wagner.

Seattle, Wash., reports an aggregate building construction for 1914 which places this city fifth among 68 principal cities in the United States. The total value of the building permits issued during the year was $3,300,000.

Washington, D. C.—A class in heating and ventilating has been instituted in Washington by James A. Donnelly, of New York. Mr. Donnelly's headquarters in Washington during the winter are Room 222, Colorado Building. The class meets every Thursday evening in the assembly room of the Builders and Manufacturers' Exchange. Twenty-five students have already enrolled.

E. A. Munro, heating and ventilating engineer, has opened an office in New York, at 1870 Hudson Terminal Building, 50 Church Street. Mr. Munro will specialize in correcting defective and inadequate heating systems. He was engaged for many years as a consulting engineer for heating and ventilating plants in Baltimore, Md.

Omaha, Neb.—A "Buy It Now" campaign has been inaugurated by a national committee whose headquarters are in Omaha, Neb. It was started by the Agricultural Publishers' Association and is directed primarily to the farmer, but also to everyone through every possible means of publicity. The public is urged to buy now those goods which of necessity must be bought during the coming few months. The chairman of the committee is C. O. Rosewater.

American Institute of Architects issued a draft of the second edition of its Standard Contract Documents and invited constructive criticism from architects and all who are connected with the building trades, whether acting as individuals or organizations. It was urged that all criticisms, which had to be sent by March 1 to receive consideration, be submitted in the form of amendments. A final draft of The Standard Documents will be made about April 1. It is not the intention of the institute to continue the publication of the Uniform Contracts, since it is stated that all who have studied the subject are agreed that the requirements of modern practice have far outgrown the very restricted range of subjects treated in that document. Additional copies of The Standard Documents may be had from E. C. Kemper, The Octagon, Washington, D. C. Included in The Standard Documents are : (A) Form of agreement; (B) General conditions of the contract; (C) Bond of suretyship; (D) Agreement and general conditions in one; (E) Form of sub-contract.

New York.—It is announced that the first form in Industrial Journalism has been established at the New York University under the auspices of the New York Trade

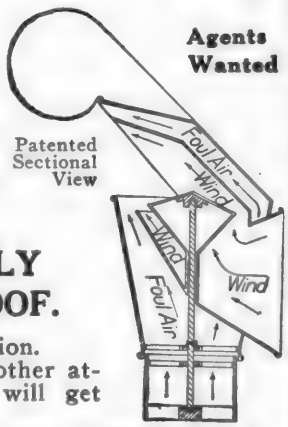
"A Radiator Valve that Can't Leak"

is the title of a booklet that should be in the hands of every person interested in any way in heating systems. It contains complete information about radiator valves in general and Detroit Packless Radiator Valves in particular. Ask for booklet V-46.

DETROIT LUBRICATOR COMPANY
DETROIT, U.S.A.

American Standard Automatic Air Pump

Having a Special NO-DOWN-DRAFT feature, it insures a steady upward pull at all times.



Patented Sectional View

ABSOLUTELY STORM PROOF.

Needs no attention.
Has no fans or other attachments that will get out of order.
Will give an average displacement at the rate of over 1000 linear feet per minute.

Specified by the New York and Massachusetts Boards of Education.

Century Ventilating Co.,
73 Guernsey St., Brooklyn, N. Y.

Press Association. The lectures will be given Wednesday evenings in February to May and are especially for students and others interested in industrial journalism. Cards of admission may be obtained free. Among the speakers will be Charles T. Root, E. A. Simmons, James H. McGraw, H. M. Swetland, John A. Hill, W. H. Ukers, W. H. Taylor and John Clyde Oswald.

National Pipe and Supplies Association will hold its annual convention in Buffalo, N. Y., May 11-13, 1915. Headquarters will be at the Lafayette Hotel.

Central Station Heating Notes.

Des Moines, Ia.—Acting on a minority report of a joint committee from the Chamber of Commerce and the city council, the directory board of the Chamber of Commerce has recommended that the city council start negotiations immediately with the Continental Gas & Electricity Company for the establishment of a central heating and lighting plant in Des Moines. Two franchises were sought, one by the Des Moines Electric Company and one by the Continental company. The Des Moines Electric Company had agreed to install at once a heating system to cost at least $300,000 and to have the plant in operation at the opening of the winter in 1915. No rate proposition was made in the statement, but it was stated that a schedule of rates for a term not to exceed five years should be agreed upon, with a readjustment at that time. It was proposed that during the life of the initial rates, the company was to keep such records as would permit the fixing of the cost of production at the end of the time of experiment. The application for the Continental Company's franchise, which involves the expenditure of at least $125,000, was presented by W. H. Abbott, of Abbott & Eaton, consulting engineers for the Continental company.

South Bend, Ind.—A new contract providing for the laying of a conduit from the heating plant of the Indiana & Michigan Electric Company to the Oliver Hotel, to supply the latter with steam for heat, power and cooking purposes, has been placed in the hands of the Board of Works for the city's consideration. The new proposed contract differs from the one considered last summer. Under the new measure the Oliver Hotel Company itself would lay the line, maintain it and take care of the pavement and sidewalks over it. It was pointed out that there was objection to the first draft because the electric company, in being given the right to lay the main,

Pure Air—

Free from dust and odors——

Buildings that are

"Carrier Equipped"

are comfortable, pleasant and healthful in summer, winter—all the year round.

You should get acquainted with the CARRIER apparatus. It is the product of the greatest engineering staff in the business.

Write for Catalog 13-36

Really a text book on
Air Washing and Humidifying

Carrier Air Conditioning Co. of America

39 Cortlandt St., New York
Buffalo Boston
Philadelphia Chicago

might thereby be given an opportunity to branch out and monopolize the heating business in South Bend. It is expected that the contract will contain provisions that the steam conduits cannot be assigned by the hotel company without the written consent of the board of works and the common council, and the other is that no other line will be permitted to tap into the steam line without similar written consent.

Portage, Wis.—An appropriation of $15,000 for a central heating plant in Portage has been made by the Board of Supervisors of Columbia County. The finance committee has the matter in charge.

Jacksonville, Ill.—The sum of $20,000 has been appropriated in Jacksonville for the purpose of building, maintaining and equipping a central heating plant.

Hibbing, Minn.—Work has been completed on the installation of a municipal heating system in Hibbing. The waste steam from the power plant will be utilized and sold at a rate of 60 cents per 1,000 lbs.

Kingwelton Talks—No. 2.

DUST AND FOREIGN MATTER ARE ELIMINATED AT SMALL OPERATING EXPENSE

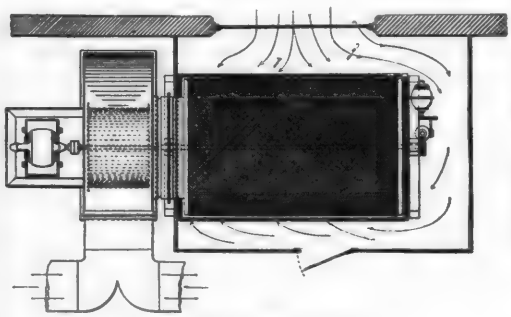
in public buildings, residences, etc., with the

KINGWELTON ROTARY AIR PURIFIER

The usual revolution is one per minute, at which speed the power required is

1 H.P. PER 50,000 CU. FT. OF AIR PER MINUTE

supplied to the building and other volumes in proportion.



Patented April 13, 1912
Plan View

A FEW INSTALLATIONS

New York City

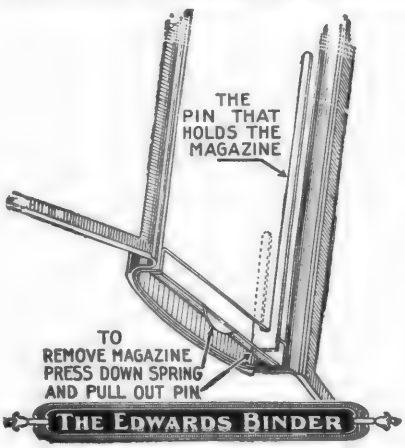
Singer Building
National Park Bank
Breslin Hotel
Flat Iron Restaurant
Residence of Mr. A. G. Jennings

Other Cities

Pennsylvania Depot, Union Station, Pittsburgh, Pa.
Pennsylvania Depot, Union Station, Washington, D. C.
American Mfg. Co., Greenpoint, L. I.
Independent Order of Foresters, Canada
People's Gas Co. Building, Chicago, Ill.

Write for descriptive circular.

WELLS & NEWTON CO.
Avenue B and 17th St., New York



Preserve Your Back Numbers

—OF—

THE HEATING AND VENTILATING MAGAZINE

Valuable reference articles are appearing from month to month.

Preserve them in one of these up-to-date binders

It's as simple as filing letters and requires NO PUNCHING OF HOLES in the magazine.

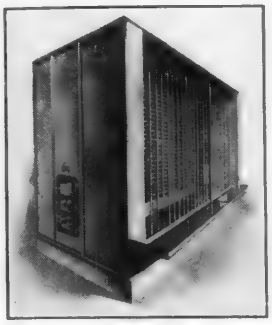
This binder is a new and practical device which has many advantages over the old styles. Single copies can be inserted or removed without disturbing the others, by simply pressing a spring.

Cloth covered, with **"The Heating and Ventilating Magazine"** stamped in gold.

PRICE 75 CENTS, Postpaid

Address: **The Heating and Ventilating Magazine, 1123 Broadway, New York**

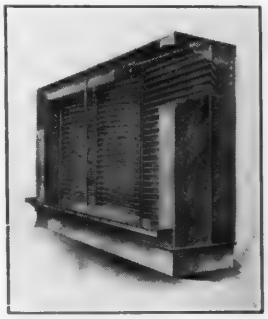
Please mention THE HEATING AND VENTILATING MAGAZINE *when you write.*



Webster "Type A" Air Washer

WEBSTER Air Conditioning APPARATUS

is designed and built to meet the individual requirements of each installation.



Webster "Standard" Air Washer

NO ONE TYPE of apparatus is best suited for all kinds of service, but for each condition such as Air Cleansing, Air Cooling, Humidifying, etc., there is a type of Webster Air Conditioning Apparatus that is most effective for the specific service.

For this reason more satisfactory results can be secured than is possible with a type that has been designed in an attempt to meet all conditions.

While Webster Air Conditioning Apparatus is made in several types, each type is of the same high class design—constructed of the same high class material and workmanship—a standard that is always maintained.

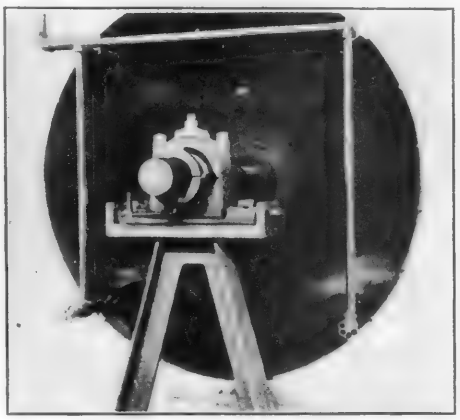
Consult us before writing your next specification.

WARREN WEBSTER & COMPANY, CAMDEN, N. J.

Established 1888 **24 Branch Offices**

NO EXTRA SPACE NEEDED

for the air washer when you install a



Zellweger Air Washing and Cooling Fan (Patented) in operation showing distributing and sprinkling pipes, water-spreaders and sprays.

ZELLWEGER AIR WASHING AND COOLING FAN

1. Requires only as much space as an ordinary centrifugal fan of equal capacity.
2. Can be installed in suitable units in any part of a building.
3. Blows more air than a standard centrifugal fan.
4. Furnishes more air for equal power than older forms of air washer with any kind of fan.
5. Purifies and cools air more than earlier forms of air washers.
6. Self-cleaning.
7. Four apparati combined in one—blower, purifier, eliminator, circulator.
8. Can be applied to any centrifugal fan.
9. Perfects warm air heating systems and enlarges them into cooling systems.

OUR CATALOGUE GIVES FULL DETAILS

J. ZELLWEGER & SONS

1900 Adelaide Avenue **St. Louis, Missouri**

Peru, Ind.—The auditing of the account system of the Peru Heating Company is now in progress. The results will be submitted to the Public Service Commission, in connection with the company's petition to increase its rates.

Tacoma, Wash.—The proposition of a central heating system in Tacoma will shortly come up again before the city council on the request for a franchise from the Central Heating Company. A franchise was granted some months ago to this company, but a referendum vote was petitioned for by a number of stationary engineers of Tacoma and the franchise holders would not agree to incur the expense of an election, as is required by law. Mayor Fawcett has expressed himself as in favor of a municipally-owned plant. Members of the city council, however, are opposed to bonding the city for any more municipal projects or going into competition with any more private corporations.

Manufacturers' Notes.

American Radiator Co., Chicago, Ill., at a meeting of its directors, February 2, 1915, declared a quarterly dividend of 4 per cent, instead of the regular 2½ per cent dividend. The directors also declared the regular quarterly disbursement of 1¾ per cent on the preferred stock. The action increases the yearly dividend on the common stock from 10 per cent to 16 per cent. At this time of year for three previous years the directors have declared extra dividends of 10 per cent, payable in common stock, but an increase in the regular rate was decided upon this time instead of the stock distribution.

International Heater Co., Utica, N. Y., held a convention of its sales force at its home offices in Utica early in February. Among the speakers at the business and other sessions were C. M. Lyman, advertising manager; R. V. Edel, Howard Neal, E. H. Remig, W. G. Jones, superintendent of the foundry; J. K. Simpkins, eastern sales manager; G. A. Tyler, J. B. Orbison, I. L. Jones, treasurer; and D. E. McCabe, Chicago manager; and H. A. Simmons.

American Radiator Co., Chicago, Ill., is now operating its La Porte plant on full time, commencing January 27, giving employment to about 300 men. The other branches of the company are also operating on full schedule.

Pittsburgh, Pa.—The merger is announced of the Best Mfg. Co., with plant and offices at Oakmont; the Kennedy Mfg. & Engineering Co., the Stroh Steel Hardening Process Co., and the Lawrence Steel

YOU CAN'T BACK THE WATER OUT OF THE BOILER!

IF YOU INSTALL THE HUTCHISON VAPOR HEATING SYSTEM

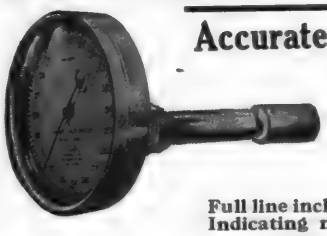
NO CHECKS, FLOATS OR THERMOSTATIC VALVES USED

BEST HEATING SYSTEM EVER DEVISED

Simplicity -- Accuracy -- Economy -- Low Cost Installation

USE LETTER HEAD AND WRITE FOR FURTHER INFORMATION

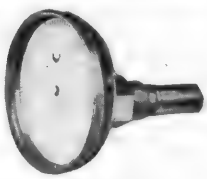
HUTCHISON VAPOR HEATING CORPORATION, WOODWARD BLDG., WASHINGTON, D. C.



Accurate Service Is Assured When You Use

Standard Indicating and Recording Thermometers

Guaranteed Correct



Full line includes seven types of recording thermometers and a special line for mechanical uses
Indicating mechanical thermometers are furnished with extensions from 2 to 30 in. in length

All thermometers are double and not breakable.

STANDARD THERMOMETER COMPANY Clinton and Shirley Streets BOSTON, MASS.

Please mention THE HEATING AND VENTILATING MAGAZINE *when you write.*

THE Minneapolis Post Office shown above has two Sturtevant Air Washers; one has a capacity of 34,800 cu. ft. and the other a capacity of 20,300 cu. ft. per minute.

Sturtevant Multivane Fans, Tempering Coils and Heaters are also installed.

Sturtevant Air Washers are used in the following buildings:

C. P. R. Vancouver Hotel, Vancouver, Can.
Bureau of Engraving and Printing, Washington, D. C.
Kansas City Union Passenger Station
Standard Oil Building, San Francisco
Geology Building, University of Chicago

Send for catalog 225-V

B. F. STURTEVANT COMPANY

Hyde Park, Boston, Mass.

AND ALL PRINCIPAL CITIES OF THE WORLD

Casting Co. The title of the new firm is the Kennedy-Stroh Corporation. The corporation has an aggregate property value of $2,500,000. The officers are: President, W. H. Schoen, Pittsburgh; vice-president, J. E. Kennedy, New York; treasurer, J. L. Kendall, Pittsburgh; general manager, W. Y. Stroh; director of sales of the Best department, Berthold Floersheim.

Kanawha Mine Car Co., Charleston, W. Va., manufacturers of the Bernhard water tube and Bernhard smokeless boilers, announces the appointment of Ernest Mehring as manager of the company's western branch, at 175 Jackson Boulevard, Chicago.

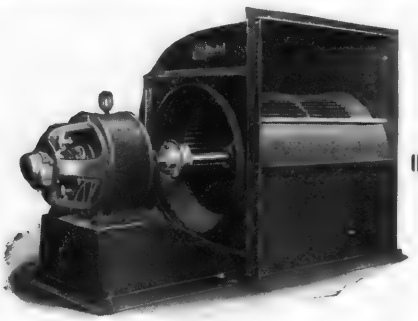
American District Steam Co., North Tonawanda, N. Y., announces that it has placed its general engineering department under the management of J. G. DeRemer, a member of the American Society of Mechanical Engineers and of the American Institute of Electrical Engineers. Mr. DeRemer was formerly chief mechanical and electrical engineer for the United Light & Power Co., of San Francisco, Cal. He will specialize in plant efficiency, making inspections, repairs, tests and recommendations, looking to obtaining the greatest efficiency in the operation of central station heating systems now in operation, as well as future installations.

Thatcher Furnace Co., New York, manufacturer of boilers and warm air heaters, will remove its main offices and showrooms next month to larger quarters at 131-137 West 35th street.

New Firms and Business Changes.

Cole, Ives and Davidson, 61 Broadway, New York, is the name of a recently-formed partnership for the general practice of engineering. The firm is composed of William W. Cole, 43 Exchange Place, and Arthur S. Ives and Rolland A. Davidson, composing the firm of Ives and Davidson, of 84 William street. The new firm will give special attention to investigations and reports for financial interests, inventories and valuations of public utility or industrial properties and to the design, installation or management of power plants of all descriptions.

Nichols & Prall, Spencer, Ia., is the new title of the heating, plumbing and engineering business conducted by J. H. Nichols. Mr. Nichols recently sold a half interest in the business to T. M. Prall.



Reasons Why

You should specify---

"Sirocco"
TRADE MARK.

Multi-Blade Fans and Blowers

1. **Because** they handle twice as much air, consuming less power than paddle wheel fans of same wheel diameter.
2. **Because** their design makes it possible for every bit of energy consumed; produce the maximum amount of air.
3. **Because** their high mechanical efficiency keeps their upkeep costs down to the minimum.

Bulletin No. 109 will be mailed at your request.

AMERICAN BLOWER COMPANY

DETROIT, MICHIGAN U S.A.

Please mention THE HEATING AND VENTILATING MAGAZINE *when you write.*

Move to attack
The Eiffel Tower is now the central military wireless station of France. From it radiate the messages, the commands that direct the whole army of France battling on its 320-mile front. A breakdown in that station of any of the apparatus would mean little short of a catastrophe for the allied armies.
Sturtevant FANS
(REG. U. S. PAT. OFF.)
are relied upon by the French Government to keep the set in operating condition. They were bought at the outbreak of the war to cool and ventilate the powerful spark gap of this apparatus.
This is proof of the fact that the merits of Sturtevant Fans are realized by foreign experts who must have the best regardless of other considerations.
We have manufactured more fans during the last half century than all our competitors combined. Some of our fans have been running for twenty-five, thirty, or even forty years. Write for catalogs, mentioning this paper.
B. F. STURTEVANT COMPANY
Hyde Park Boston, Mass.
and all principal cities of the world
EIFFEL TOWER IN PARIS
AND ONE OF THE STURTEVANT FANS USED THERE

W. C. Mullen Plumbing & Heating Co., Austin, Minn., has recently changed hands, the new owner being Mr. Crane, of New York. Mr. Mullen has retired from the heating business to become manager of the Dubuque Three I baseball league.

Business Troubles.

Typhoon Fan Co., New York, 1544 Broadway, New York, manufacturer of ventilating fans, had a petition in bankruptcy filed against it January 20, the petitioners being the Exhibitors Times, Inc., $242; McCabe Hanger Mfg. Co., $71.00; and the Chalmers Publishing Co., $208. The company was incorporated May 9, 1912, with the capital stock of $5,000. The liabilities are said to be about $3,000. On March 1, Judge Hough dismissed the petition.

Chauncey P. McKnight, New York, steam heating contractor, has failed with assets of $13,944 and liabilities of $22,829.

New Incorporations.

D. G. C. Trap & Valve Co., Inc., New York, capital $25,000, to manufacture and install plumbing, steam heating, ventilating, electric apparatus, drying and refrigerating systems. Incorporators: A. A. Cryer, New York; J. H. Eastwood, Belleville, N. J.; and George C. Livingston, Jobstown, N. J.

Meyers Mfg. Co., Philadelphia, Pa., to manufacture heating apparatus, capital, $50,000. Incorporators: C. D. Myers, Geo. H. Dunn and E. Haegy, Lancaster, Pa.

Bay City Plumbing & Heating Co., Bay City, Mich., capital $2,400.

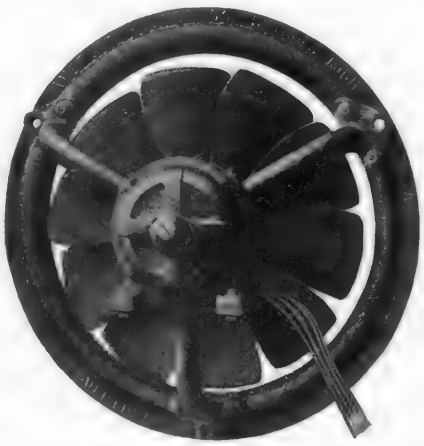
Lincoln Railway & Heating Co., Lincoln, Ill., capital $15,000. Incorporators: J. R. Patton, John A. Hoblit and Frank S. Bevan.

Davidson Fan Co., Augusta, Me., capital $25,000, to manufacture ventilating fans and other apparatus. President and treasurer, E. M. Leavitt, of Winthrop; R. L. Thomas Co., Charlottesville, Va.; capital $5,000, to conduct a heating and plumbing business. President and treasurer, R. L. Thomas; secretary, G. M. McNutt.

Safety Water Heater Co., Chicago, Ill., capital $20,000, to manufacture water heaters. Incorporators: Thomas L. Stitt, Henry A. Gano and Herman Wagner.

Merrill Process Co., Boston, Mass., capital $75,000, to manufacture heating and drying machinery. Incorporators: F. H. Swift, John C. Heyer and A. N. Rice.

H. P. Hess Heating & Plumbing Co., Schenectady, N. Y., incorporated to conduct a heating, plumbing and tinning business.



Westinghouse-Ventura Ventilating Fans

possess the following special features:

High Efficiency—Note the special construction of the fan. This design, together with the high electrical efficiency of the motor, insures the movement of the maximum amount of air for a given amount of power consumed.

Quiet Operation—Suitable for use in churches, hospitals, etc., where noise would not be tolerated.

Little Attention Required—An occasional inspection of the motor and lubrication of the bearings is the only attention necessary.

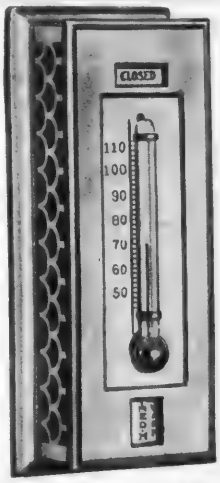
Enclosed Motor—Motor is completely enclosed and protected from dirt, steam, etc.

Compactness—Motor projects but little into the room when fan is installed in wall.

Made in sizes of from 18¾ to 32 inch wheel diameter. Send for publication, giving full description, capacities, dimensions, prices, etc.

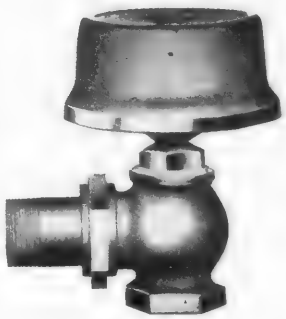
Westinghouse Electric & Manufacturing Co.
East Pittsburgh, Pa.

Johnson Model Thermostat



only four and three-quarter inches long, two inches wide and one inch deep, copied from the design of one of the greatest architects in the country, with the "Open and Closed" INDICATOR to show when the heat is turned "On" or "Off" and a POSITIVE SHUT-OFF for fresh air sleeping rooms. It is the final touch to an ideal heating system

Johnson Sylphon Valve



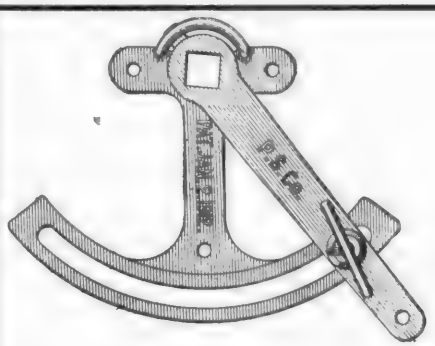
in which the RUBBER diaphragm is replaced by the METAL SYLPHON BELLOWS, which will not vulcanize, crack and leak, reducing the repairs to a minimum and increasing the efficiency and desirability of Johnson System of Automatic Temperature Regulation.

Write for Booklet.

JOHNSON SERVICE COMPANY

Milwaukee, Wisconsin

NOTICE—We are the owners of Patent No. 924,235 relating to the automatic control of humidity. Infringers and unlicensed users will be prosecuted.



Specification

"Furnish and install, in all heat and vent flues, adjustable Dampers and, in all branch ducts, movable Deflectors equipped with Parker Damper Quadrants (manufactured by the Parker Supply Company, 515 West 45th Street, New York City), which permit of the Dampers and Deflectors being held in any desired position."

The net result of making the above a part of your damper specifications is 100% damper regulating efficiency—maximum satisfaction. For

Parker's Damper Quadrant

is conceded by Engineers and Sheet Metal Workers, alike, to be the simplest, neatest and most efficient device for controlling dampers and deflectors.

It has only two parts—lever and frame. And the lever locks right onto the frame, doing away with the need of drilling and the use of pins, springs, nuts, bolts, etc. Result: a better and neater job.

The Quadrant is in use in some of the world's greatest and costliest buildings—the Woolworth, the Municipal and the Hudson Terminal in New York; the Bellevue-Stratford Hotel in Philadelphia; the Technical High School in Jersey City; the Bureau of Engraving and Printing Building in Washington and scores of others as prominent.

We have a booklet which illustrates and describes it in detail. May we send you a copy for your files?

PARKER SUPPLY COMPANY

Manufacturers of Engineers' and Sheet-Metal Workers' Specialties

515 WEST 45th STREET NEW YORK

Toledo Metal Mfg. Co., Toledo, O. capital $60,000, to manufacture boilers and storage tanks. Incorporators: Joseph F. Grosswiler Wilbur Owen and C. W. Owen.

Hayward-Bronaugh Co., 406 West Erie St., Chicago, Ill., has been incorporated to conduct a manufacturing and contracting business in sheet metal work, with special attention to ventilating systems, dust removal and boiler breeching construction. The new firm is composed of William L. Bronaugh, until recently treasurer of the Iroquois Engineering Company, Chicago, and secretary of the Illinois Chapter of the American Society of Heating and Ventilating Engineers; and R. B. Hayward, formerly treasurer of the Mellish-Hayward Co., of Chicago.

Business Chances.

Washington, D. C.—Sealed proposals will be received at the office of the Supervising Architect, Treasury Department, for the following-named work:

Until March 22, 1915, for the construction complete, including mechanical equipment, etc., of the U. S. Post Office at Everett, Wash. Two stories and basement, 10,300 sq. ft. ground area.

Until March 22, 1915, for the construction complete, including mechanical equipment, of the U. S. Post Office and Court House at Brattleboro, Vt. Three stories and basement, 6,225 sq. ft. ground area.

Until March 25, 1915, for the construction complete, including mechanical equipment, etc., of the U. S. Post Office and Court House at Pendleton, Ore. Three stories and basement, 5,500 sq. ft. ground area.

Until March 29, 1915, for the construction complete, including mechanical equipment, etc., of the U. S. Post Office at Smyrna, Del. One story and basement, 2,200 sq. ft. ground area.

Until March 15, 1915, for the construction complete, including mechanical equipment, of the United States Post Office at Greenfield, Mass. Two stories and basement, 4,600 sq. ft. ground area.

Until April 2, 1915, for the construction complete, including mechanical equipment, of the U. S. Post Office at Plainfield, N. J. One story and basement, 9,100 sq. ft. ground area.

Until April 6, 1915, for the construction complete, including mechanical equipment, of the U. S. Post Office at Live Oak, Fla.

New Contracts.

J. P. Dwyer Co., Boston, Mass., heating a city apartment building at Harrison and Massachusetts Avenues for $2,552.

Peters-Eichler Heating Co., Toledo, O., remodeling heating system in armory from gravity to vacuum. The same system will be used in the new court house and county jail.

Tholen Bros., Leavenworth, Kan., heating new army service schools library at Fort Leavenworth, for $2,296.

John Cunningham Co., Springfield, Mo., heating new Heer-Andres Building, on the site of the old court house in the public square, for $9,000.

Bartlett Bros. Co., Cleveland, O., heating and ventilating West Austintown School for $4,100. Other bids were: McGinnes Co., Pittsburgh, $3,643 (low bid); Lamneck Co., Columbus, O., $4,950; Columbus Heating & Ventilating Co., $4,709.

Clark & Jones, Lima, O., heating and ventilating new Grace M. E. Church in South Lima. The multiple-vapor system will be installed.

Barnes & Fleming Co., Pittsburgh, Pa., heating new municipal dairy barn at Marshalsea.

Hoben & Doyle, Philadelphia, Pa., heat new Municipal Hospital in Philadelphia; the plumbing contract went to William McCoach, Jr.

SUPERIOR
in Every Detail
Is the
Ric-wiL MethoD
of
Insulating Underground Pipes
Investigate WHY before you BUY
The Ric-wiL Underground Pipe Covering Co.
623 New England Building, Cleveland, O.

BOOKS ON HEATING AND VENTILATION

ELEMENTS OF HEATING AND VENTILATION. By Arthur M. Greene, Jr. A text book for technical students and a reference book for engineers. 330 pages. Size 6 x 9½ in. 223 ills. Price, $2 50 postpaid.

HEATING SYSTEMS, AND THE DESIGN OF HOT WATER AND STEAM HEATING APPARATUS. By F. W. Raynes. A new English work, with large number of charts, and showing unique methods for sizing pipes of different systems. A book intended for the busy professional man, as well as for students. 328 pages. Size 6 x 9 in. Illustrated. Price, $3.50 postpaid.

MECHANICAL EQUIPMENT OF FEDERAL BUILDINGS UNDER CONTROL OF THE TREASURY DEPARTMENT. By Nelson S. Thompson, chief mechanical and electrical engineer, office of the supervising architect. Second edition, revised and enlarged. Contains the basic data used in the design of the mechanical and electrical equipment of Federal buildings under the control of the Treasury Department. Also contains data for approximating the cost of the various parts of the work. The book takes in heating and ventilation, plumbing, stationary and portable vacuum cleaning plants, engines and generators, motors and controlling apparatus, forced systems of hot water heating, commercial practice in factory heating, etc., and other valuable data. Cloth, $2.00.

CENTRAL STATION HEATING. By Byron T. Gifford. This work presents the most advanced practice in central station heating, both steam and hot water, and is an invaluable guide, not only to the engineer, but to municipalities and public service commissions where district heating is being, or will be, used. 208 pages, with 42 figures, including 50 pages of miscellaneous engineering data. Size 6x9½ in., bound in flexible leather. Price, $4.00.

MECHANICS OF HEATING AND VENTILATING. By Konrad Meier. Including a series of ten charts containing data relating to the flow of water, steam and air, collected by Mr. Meier during an experience of 26 years in heating and ventilating work, both in this country and abroad. Each of the charts replaces a series of tables on the subject, giving at a glance the result of a calculation from any combination of factors. 161 pages, illustrated, with ten large charts. Size 6 x 9 in. Price, $5.00. Separate sets of charts, printed on cloth, with lines in different colors and mounted on boards. Single charts, $1.50. Sets of ten charts, $15.00.

HEATING AND VENTILATING BUILDINGS, a standard manual for heating engineers and architects. By Prof. R. C. Carpenter. Sixth edition, largely rewritten. 577 pages, 277 illustrations, 8vo, cloth, $3.50.

HANDBOOK FOR HEATING AND VENTILATING ENGINEERS. By Prof. James D. Hoffman and Benjamin F. Raber. The latest book on this subject. Unusually comprehensive. 320 pages, with 45-page appendix. Size 4½ x 6¾ in., bound in flexible leather. Price, $3.50.

PRACTICAL MANUAL OF STEAM AND HOT WATER HEATING. By E. R. Pierce. Especially useful to men engaged in installing steam and hot water heating apparatus. Easily understood and comprehensive. Boiler ratings exhaustively treated. 359 pages. Size 5½ x 8½ in. Cloth, $2.50.

QUESTIONS AND ANSWERS on the Practice and Theory of Steam and Hot-Water Heating. By R. M. Starbuck. Illustrated. $1.00.

PROGRESSIVE FURNACE HEATING. By Alfred G. King. A practical manual of designing, estimating and installing modern systems for heating and ventilating buildings with warm air. Written especially for contractors and mechanics. Size 6 x 9 in. 280 pages. 189 illustrations. Price. $2,50 postpaid.

PIPE FITTING CHARTS. By William G. Snow. A valuable reference work for the solution of knotty problems in connecting up steam radiators, boilers and the variety of appliances used in combination high and low pressure plants. 285 pages. 232 illustrations. Price, $1.50.

STEAM POWER PLANTS; Their Design and Construction. By Henry C. Meyer, Fr., M. E. Third edition, fully revised. One of the standard works on the design and construction of power plants. Covers proportioning boilers, selection and writing specifications for steam engines, selection and arrangement of auxiliaries, construction of chimneys, coal handling, etc. 219 pages. Size 6 x 9 in. Illustrated and with folding plates. Price, $2.00 postpaid.

STEAM POWER PLANT PIPING SYSTEMS. By W. L. Morris, M. E. A complete treatise on design, installation and maintenance, covering the details of all phases of piping and giving much space to the subject of maintenance. Expert advice given on problems arising from mistakes and breakdowns in the piping. 490 pages. Size 6 x 9 in. 389 ills. Price, $5.00 postpaid.

PRACTICAL STEAM AND HOT WATER HEATING. By Alfred G. King. Containing over 300 detailed illustrations. The book is a working manual for heating contractors, journeymen steam fitters, architects and builders. Describes various systems of heating and ventilation and includes useful data and tables for estimating, installing and testing such systems. 8vo. 367 pages. Price, $3.00.

POWER, HEATING AND VENTILATION. By Charles L. Hubbard, BS., M.E. A treatise for designing and constructing engineers and architects. The whole subject of heating is covered, including the heating of large institutions with central plants. Space is also devoted to electrical matters connected with steam plants. 647 pages. Price, $5.00 (three volumes in one).

NOTES ON HEATING AND VENTILATION. By John R. Allen. 152 pages. 34 illustrations. Size 4½ x 6½ in. One of the new books, brought quite up to date, and containing much information to guide the intelligent steam fitter in the installation and heating and ventilating apparatus. Cloth, $2.50.

STEAM FITTERS' COMPUTATION AND PRICE BOOK, ABRIDGED. By Mark Dean. Price, $2.50.

THE PRINCIPLES OF HEATING. By William G. Snow. A practical and comprehensive treatise on Applied Theory in Heating. 161 pages. 42 illustrations. 38 tables. Size 6 x 9 in. Cloth, $2.00.

STEAM AND HOT WATER HEATING. By H. C. Lincoln. A new book giving an elementary knowledge of the principles of steam and hot water heating, together with their practical application to the design of complete systems. 160 pages, illustrations. Size 6x9 in. Price, $1.00.

ADDRESS
The HEATING and VENTILATING MAGAZINE 1123 Broadway NEW YORK

Please mention THE HEATING AND VENTILATING MAGAZINE *when you write.*

Garrett Heating & Plumbing Co., Clarksburgh, W. Va., heating new State Board of Control Building at Terra Alta, W. Va.

L. E. Andrews & Co., Gloucester, Mass., heating and ventilating the new Portuguese church in that city.

Norton & Smith, Seattle, Wash., heating and plumbing in new building for the Northern Life Insurance Company, the total cost of the building being $60,000.

M. A. Dame & Son, Lynn, Mass., heating and ventilating addition to the English high school building in that city, for $32,800. Other bids were: J. F. Morgan & Son, $33,-937; Reardon Bros., $34,786.

Ernst Bros., Detroit, Mich., heating addition to the People's State Bank in Detroit, for $20,000.

Hutchison Vapor Heating Corporation Reorganizes with $100,000 Capital.

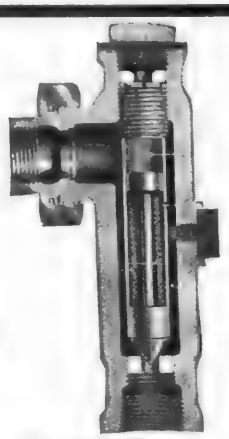
Owing to the large increase in the business of the Hutchison Vapor Heating Corporation, a reorganization has been effected, whereby the old company has been completely dissolved and a totally new one formed, bearing the same name. The new company is operating under a Virginia charter, with a capital stock of $100,000, all common. The officers for the first year are: President, Harold B. Chase; vice-president and engineer, M. S. Cooley; treasurer, H. E. Hanes; secretary, M. Frank Hutchison. The board of directors for the first year consists of Harold B. Chase, H. E. Hanes and M. Frank Hutchison.

It will be noted that Mr. Hutchison, the inventor of the system, remains with the company. The company's engineer, M. S. Cooley, M. E., Cornell University, is well-known in the heating trade. He was formerly assistant superintendent of the mechanical division of the United States Treasury Department and is a member of the American Society of Heating and Ventilating Engineers.

The main office of the company has been moved from Herndon, Va., to Washington, D. C., where enlarged quarters have been taken in the former branch office in the Woodward Building. The warehouse is still continued at Herndon.

The company is engaged in the manufacture and sale of the Hutchison system of vapor heating, consisting of the well-known modulation vapor valve, trap-receiver and damper regulator, all of which specialties are protected under the United States patent laws. The engineering department is in a position to take up with heating contractors and fitters the question of plans and layouts and is equipped to do this work. The company's catalogues treat of the various devices in detail as well as giving other information on vapor heating.

COSTS LESS—DOES MORE
AND DOES ITS WORK BETTER



Interior View

There is no comparison between

SARCO
Vacuum Valves
and other valves

Simplicity the main feature.

No moving parts to stick, bind or corrode.

Will not leak steam.

Positively noiseless in operation.

Does away with water hammer and water seals.

350,000 Sarco Valves sold in five years. Let us tell you the reason.

Thirty days' free trial to any responsible concern.

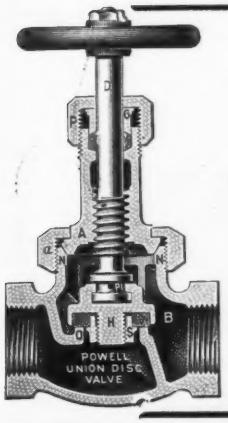
Write now for lists and prices.

SARCO ENGINEERING COMPANY

116 Broad St., New York

Old Colony Bldg.

Chicago



POWELL VALVES

FOR HOT WATER OR STEAM HEATING

Five Points of Efficiency Combined in the POWELL Union Composite Disc Valves

1. Body symmetrically designed and well-proportioned. 2. Metal distributed to meet most wear 3. Union bevel ground joint connection between body and bonnet, red lead or cement unnecessary to make them tight. 4. Disc-holder "H" permits the use of any make of rubber discs. 5. All parts made to gauge and are interchangeable.

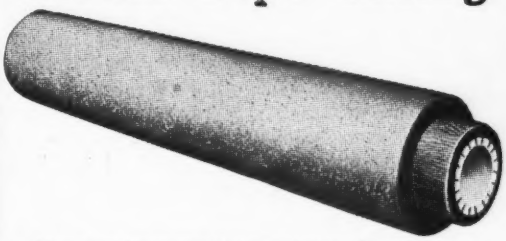
Ask your dealer for "POWELL" VALVES or write us.

THE WM POWELL CO.

DEPENDABLE ENGINEERING SPECIALTIES

CINCINNATI, O.

STANDARD
Steam Pipe Casing



Above cut illustrates the completion of our tin lined

STEAM PIPE CASING

We also make unlined casing.

FOR

Insulating Underground Steam Pipes

Write for CATALOG and PRICES.
We furnish all SPECIALS required.

Standard Wood Pipe Co.

Williamsport, Penna.

STEEL TANKS

For All Purposes

Riveted Tanks
Welded Tanks
Brazed Tanks

Founded 1802- -112 Years Old

Wm. B. Scaife & Sons Co.

NEW YORK OFFICE
26 Cortlandt Street

Pittsburgh, Pa.

BETWEEN THE TWO COVERS OF

Scientific Building Operation

you will find a half hundred articles written by the best authorities on building management in this country. Here are some of the subjects:

RENTING—ACCOUNTING—REPORTS—OPERATION METHODS—OPERATING COSTS
PURCHASING SUPPLIES—ELEVATORS—LIGHTING—INSURANCE—FLOOR LAYOUTS

Our special price to subscribers of **Buildings** and Building Management is $2.00 delivered to you. Otherwise, $2.50. Buildings and Building Management for one year and Scientific Building Operation, $4.00.

PATTERSON PUBLISHING CO., 918 City Hall Square Building, Chicago

Potts-Seiders Supply Co., Columbus, O., jobbers of engineers, mill, mine, factory and plumbers' supplies, announces that John T. Seiders has now become active in the management of the company and plans are being carried out for a notable expansion of the company's business as jobbers of heating material and ventilating apparatus. The company's facilities now permit of prompt delivery of such material as well as maintenance of ample stock.

Charles T. Phillips, Pacific Building, San Francisco, Cal., consulting engineer, is desirous of receiving catalogues from manufacturers of heating and ventilating apparatus.

Kennedy Valve Mfg. Co., Elmira, N. Y., on May 1, will move its New York office to 81 John St. Thomas F. Cushing is manager of this branch.

Wanted.

Salesmen Wanted. Experienced salesmen wanted in every large city and territory to handle vacuum traps and high pressure expansion traps. State full particulars in answer. Address Box 10, care of Heating and Ventilating Magazine.

H.P.Equipment

Spencer Turbine Vacuum Cleaners

are manufactured in sizes from ¾ H. P. to 40 H. P.

Send for catalogue

SPENCER TURBINE CLEANER COMPANY

HARTFORD, CT.

Dixon's Graphite PIPE JOINT COMPOUND

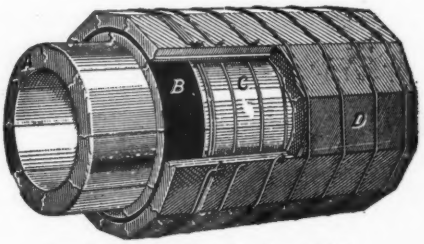
Is so far superior to red lead or white lead that there is no comparison.

Send for Booklet No. 211-D

Made in JERSEY CITY, N. J., by the

Joseph Dixon Crucible Co.

Established 1827



A—Inner Shell, 2 inches thick.
B—Asphaltum Packing.
C—Dead Air Space.
D—Outer Shell, 1 inch thick.

Cover Your Steam Pipes

WITH WYCKOFF'S IMPROVED

CYPRESS COVERING

Made of Gulf Cypress, the wood eternal

Not affected by wet and dry conditions common to steampipe trenches. Will not rot. Lasts twice as long as Pine Casing. Absolutely water and steam tight. Each shell is wound with heavy galvanized wire. Coated all over with the best known preservative—Hydrolene B.

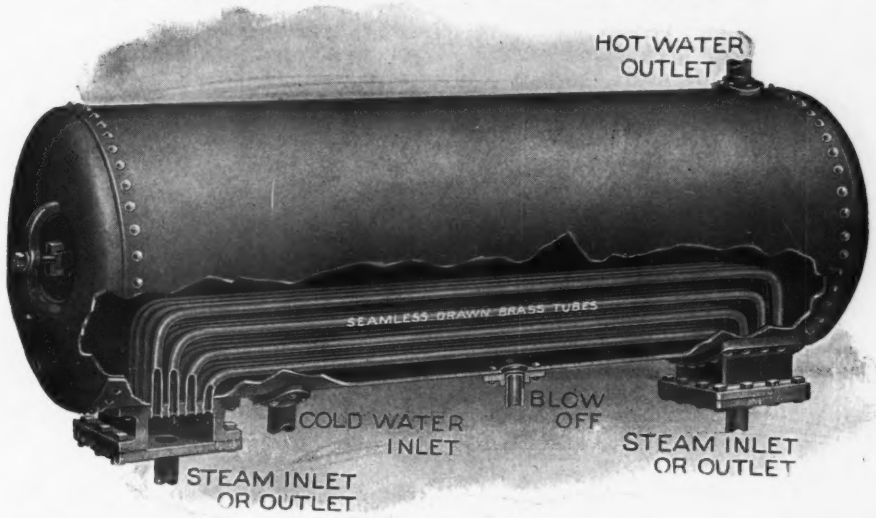
Let us answer your questions and tell you all about it. Booklet on request.

A. WYCKOFF & SON COMPANY

ELMIRA . . N. Y.

Chicago, Ill., 551 West 14th Place

THE ⌐¬ SHAPE TUBES EXPLAIN THE SUCCCESS
OF THE
PATTERSON HOT WATER TANK
for heating water for domestic or manufacturing purposes

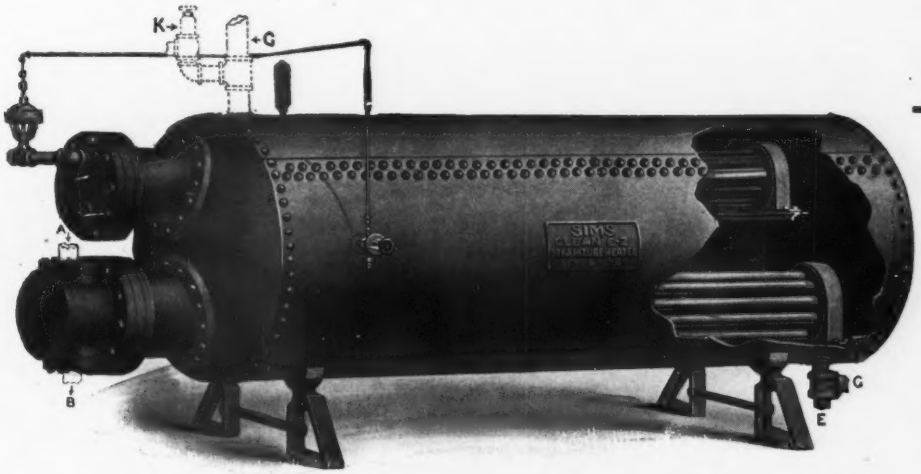


Any combination of storage and heating capacities can be furnished.

TYPE C
Patented Aug. 26, 1913

Send for catalogue

FRANK PATTERSON & CO., 26 Cortlandt St., New York
REPRESENTATIVES IN ALL PRINCIPAL CITIES



WHEN THE HOT WATER DEMAND RUNS HIGH

Our large experience in manufacturing heaters for laundries has developed the fact that there is not always enough exhaust steam to heat all the water to the temperature required. This is always the case with a wet-wash laundry. For a high hot water demand use the

SIMS CLEAN E-Z HEATER, TYPE D.

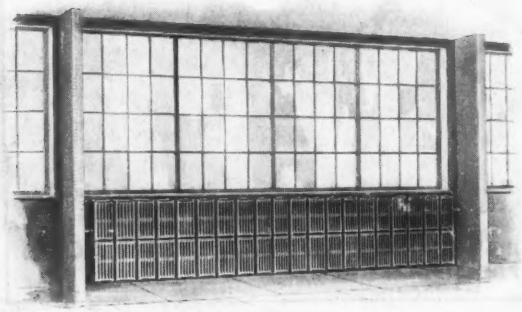
This heater is supplied with two sets of straight, seamless drawn brass tubes, the lower for exhaust steam, located in the coolest water. The upper set of tubes is for live steam direct from the boiler, controlled by a thermostat.

Our Bulletin HL-2 gives full particulars of Sims Heaters for laundries, hotels, hospitals and other service. Consultation free. All work guaranteed.

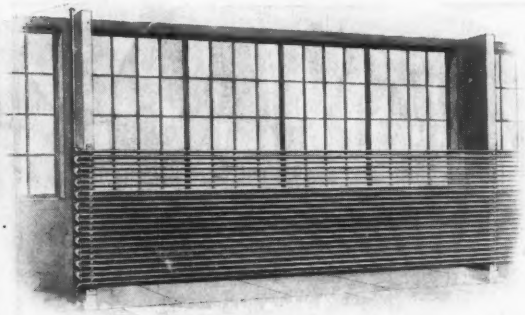
THE SIMS COMPANY **18th Street, Erie, Pa.**

Space- and dollar-saving Radiators

"A penny saved is a penny earned" is as true today as it ever was. In many buildings, factories and warehouses in particular, floor space has a dollar value. Floor space saved means more working room, more storage room, greater interest on the building investment, bigger dividends. Moreover, in these days of modern factory construction where so much glass surface is devoted to the admission of light and air, wall space is also valuable.



These AMERICAN Rococo Wall Radiators in two tiers contain 360 square feet of heating surface; distance between pilasters, 26 feet; height from ficor to window-sill, 5 feet. Radiators do not project above the window-sill.



This Pipe-coil made up of 2-inch pipe, twenty-four pipes high, contains 390 square feet of heating surface; distance between pilasters 26 feet, height from floor to window-sill 5 feet. Pipe-coil projects 2½ feet above the sill.

AMERICAN Rococo Wall Radiators

save *both* floor and wall space. They are made in sizes and styles which permit of their erection to meet almost any structural requirements, — providing ample heating surface without sacrifice of valuable floor or wall areas. An interesting comparison is illustrated herewith. When it is understood that repeated tests have shown that the condensation per square foot of these radiators is the same as pipe coils the force of this comparison will be readily appreciated by Engineers, Heating Contractors and Architects who closely analyze these important points. They are convincing in themselves, aside from other features of circulation, durability, attractiveness etc., so long established in favor of cast-iron radiation. Ask for complete illustrated catalogue, free.

AMERICAN RADIATOR COMPANY

Chicago, New York, Boston, Providence, Philadelphia, Baltimore, Buffalo, Rochester, Washington, Pittsburgh, Cleveland, Cincinnati, Detroit, Atlanta, Birmingham, New Orleans, Indianapolis, Milwaukee, Omaha, Minneapolis, St. Paul, St. Louis, Kansas City, Denver, San Francisco, Los Angeles, Portland, Seattle, Spokane, Brantford, (Ont.), London, Brussels, Paris, Berlin, Cologne, Vienna, Milan